NINETEENTH

# SEMI-ANNUAL REPORT

OF THE

# Board of Water Commissioners

TO THE

# COMMON COUNCIL

OF THE

# CITY OF CHICAGO.

JANUARY 1st, 1861.

CHICAGO:
JAMESON & MORSE, PRINTERS, No. 14 LA SALLE STREET.
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# Board of Water Commissioners.

ORRINGTON LUNT,
EDWARD HAMILTON,
BENJAMIN CARPENTER.

## Officers.

SUPERINTENDENT,
BENJ. F. WALKER.

TREASURER,
ORRINGTON LUNT.

SECRETARY,
A. W. TINKHAM.

CLERKS,
JOSIAH H. BROSS,
W. R. LARRABEE,
F. J. REED.

COLLECTORS,
CHAS. R. VANDERCOOK,
ANTON NIEMAN,
SAMUEL POLKEY,
O. F. WOODFORD.

ENGINEERS AT PUMPING WORKS,
D. C. CREGIER, Chief.
FR. TRAUTMAN, Assistant,
F. WELLS, Assistant.

# Commissioners' Report.

WATER COMMISSIONERS' OFFICE,
Chicago, Ill., Feb. 28th, 1861.

*To the Common Council*
*of the City of Chicago :*

SIRS: The Water Commissioners herewith submit a report of their proceedings for the year 1860.

But few additions have been made to the Works during the year. It has been the care of the Board to preserve the Works in their present extent in thorough repair and effective operation rather than to enlarge them. Such additions to the distributing pipes as seemed to be greatly needed have been made. The extension of the year has been limited to additions of this character.

### DISTRIBUTING PIPES LAID DURING 1860.

Less new pipe was put down last year than in any year since 1857. The amount laid in each Division of the City is as follows:

| | |
|---|---|
| North Division, - | 4,984 feet. |
| South " - - | 4,530 " |
| West " - - | 22,285 " |
| Total, - - | 31,799 feet, or 6 miles 119 ft. |

### WHOLE AMOUNT OF PIPE LAID IN THE CITY.

| | |
|---|---|
| The whole amount of main laid is, | 26,076 feet. |
| " " " " distributing pipes, | 454,531 " |
| Total of all sizes of pipes laid, - | 480,607 ft. or 91 miles 127 ft. |

### PUMPING WORKS.

At the Engine House several important improvements have been made during the year. Two chimnies have been built adjacent to the fire-rooms, on the north and south sides of the Engine House. These chimnies are so located as to be convenient for present use, and for additional boilers to be put in hereafter. The smoke pipe leading from the south boilers to the tower has been removed, and these boilers are now connected with the south chimney by a new smoke pipe.

A new smoke pipe connecting the north boiler with its chimney has been ordered by the Board, and is being made. This boiler was put in thorough repair in the earlier part of the year, and has been provided with a new felt covering.

The smaller and older of the two pumping engines was supplied with a new piston during the year, and both engines, with their boilers, are in thorough repair and working order.

The amount of water pumped during the year is reported by the Superintendent as a daily average amount of 4,703,524 gallons, exceeding the daily average of 1859 by over 21 per cent., while that of 1859 exceeded the daily average of 1858 by some 29½ per cent.

From the rapid increase in the amount of water used for the last three years, as shown in the above statement, it appears probable that it will soon become necessary to increase the pumping power. We do not consider it necessary to recommend that immediate steps be taken for this purpose. When certain proposed changes for the increase of the supply of the South Division, hereafter described in this Report, are effected, the ability of the engines we now have to give the necessary supply, can be better ascertained, and it may then be necessary to bring before your honorable body plans and estimates for such additions.

### NEW MAIN FOR INCREASING THE SUPPLY OF THE SOUTH DIVISION.

The Board has made arrangements for an additional main 24 inches in diameter, to be laid direct from the engine house down Pine street, passing under the bed of the river by a wrought iron pipe of the same size as the main; thence, by River street and Wabash Avenue, to Adams street, and thence, along Adams street, by a sixteen inch main, to the Adams street reservoir.

The South Division is now supplied by two twelve inch mains: one on Wolcott and State streets, connected with a thirty inch pipe

under the river at State street; and the other crossing the South Branch, from the West Division, by a twelve inch river pipe, at Adams street. These mains barely supply the present use of water in the South Division, and are not large enough to make it possible to maintain as good a head in this part of the city as in the other Divisions.

One plan discussed by the Board for the new main was, to branch from the twenty-four inch main now in Chicago Avenue, by a twenty-four inch main leading down Wolcott street, connecting at the river with the thirty inch river pipe, and displacing the twelve inch main, and so continue down State street to Adams street. This route would have saved the cost of the new river pipe, some $6,000, would supply less water, and would require the breaking up of the paving of State street and the disturbance of its business. The great objection to this plan of main was, that with an accident to the State street river pipe, the South Division would be almost without water, obtaining only what would be delivered from the West Division by the twelve inch river pipe at Adams street. Of the river pipes that have heretofore been put down, some have been injured and rendered useless after being put down, and with this knowledge, the Board has not felt justified in making the supply to the South Division dependent upon a single river pipe, an injury to which might take weeks to repair.

For the cast iron pipe for this main, a contract has been executed with Messrs. R. D. Wood & Co., of Philadelphia, at the rate of $34.95 per ton, delivered here, the delivery of the pipe to commence with the opening of navigation. The wrought iron pipe to be placed under the river, is being made by C. Reissig & Co., of this city, to be finished by March 15th. For the dredging and other work for putting the pipe down, the Board has bargained with Messrs. Martin Green & Co., also of this city.

This new main is the important work in the way of enlargement, proposed for the coming season. It will probably be necessary to lay more or less distributing pipes, for which the pipes should be provided early in the season.

### EXTENDING THE INLET PIPE INTO THE LAKE.

The Board has had a good deal of examination and discussion as to whether it is practicable, at a reasonable expenditure, to furnish the water supplied to the city in a purer and clearer state than we now have it. Having reference chiefly to this matter, the Board, early last March, passed the following resolution:

"That the Chief Engineer of the Sewerage Board, Mr. E. S. Chesbrough, be requested to submit a project and estimate for extending the inlet pipe so far out into the lake that the water thus obtained shall be free both from the wash of the lake shore and the flow of the river, and that he also take under consideration and report on the matter of erecting additional pumping works in such locality as shall secure a supply of pure water."

The reply of Mr. Chesbrough is given by his full and complete report on the matters submitted to him, which we have appended herewith. This report treats of all matters connected with the state of the water, which have been subjects of complaint or discussion, and we trust will have the careful consideration of the citizens generally. All of the large Works in the country have the same annoyances to contend with as we have here, such as a turbid appearance to the water when the stream or lake affording the supply is agitated, an unpleasant taste to the water two or three times in the course of the year, and the periodical presence of fish in the pipes. As stated in our last report, the risk and expense attendant upon extending a large pipe a long distance out into the lake can be estimated only by those who have had experience in erecting and maintaining structures along our lake shore. We have not felt justified in entering upon such a work without enquiring carefully into the best way of doing it, and the advantages to be secured by it. Mr. Chesbrough recommends that no change be made at present in the mode of obtaining the supply from the lake, but that examinations and analyzes be first made, testing the qualities of water obtained at different distances from the shore. If any advantage is to be obtained by going out further into the lake for the supply, it will be brought to light by such tests. We may remark here, that last spring, on one occasion when the water was unusually turbid, one of the present Commissioners made an examination, comparing the water obtained a mile from the shore with that delivered from the hydrants. The water was taken twenty feet below the surface of the lake, and as soon as was possible was compared with the water from the hydrant in this office. There was nothing to distinguish the two specimens in appearance or taste, and the positions of the two glasses containing them having been accidentally changed, it was not possible to tell which was that taken a mile from the shore, and which was the hydrant water.

## INCOME OF THE WORKS FOR 1860.

| | |
|---|---|
| The total receipts of Water Rents collected for the year amount to - - - - - - - - - - | $131,162.73 |
| The income of the Works includes not only the Water Tax, but such small amount as is received for tapping the pipes in excess over the costs for the same, amounting this year to $373.61, and making the whole income for the year - - - - - - - - - - | 131,536.34 |
| The income of the year 1859 was - - - - - | 123,600.77 |
| The excess of the income of 1860 over that of 1859 being | $7,935.57 |

## INTEREST, OPERATING EXPENSES AND REPAIRS, 1860.

| | | |
|---|---|---|
| Interest on Water Loan Bonds, and all interest, - - | | $71,474.91 |
| Expenses at the Pumping Works, including $2,557.61 for the cost of the new chimnies and smoke-pipe, - - - - - - | $20,696.78 | |
| Repairs and miscellaneous operating expenses, | 5,550.71 | |
| Office expenses, clerks, collectors, rent, etc., | 7,810.49 | |
| Salaries of Commissioners, Superintendent, and Secretary, - - - - - - - | 6,186.10 | 40,244.08 |
| | | $111,718.99 |
| Excess of income of 1860 over its interest and expenses, | | $19,817.35 |

## TOTAL REVENUE AND EXPENSES FROM THE BEGINNING OF THE WORKS.

| | |
|---|---|
| Total revenue to January 1st, 1861, - - - - - | $613,209.09 |
| Total interest and expenses to same time, - - - | 570,696.18 |
| Total excess of revenue, - - - - - - | $42,512.91 |

APPLICATION OF ALL MEANS HAD FOR BUILDING THE WORKS AND PURCHASING SUPPLIES ON HAND.

We give in brief a statement of the means by which the Water Works have been built, and by which the supplies of materials and machinery on hand have been purchased.

| | |
|---|---|
| Six per cent. Water Loan Bonds issued, $1,030,000, less by discount, $87,390.78, | $942,609.22 |
| Seven per cent. Water Loan Bonds issued, | 56,000.00 |
| Due Quintard & Whitney, | 485.49 |
| Excess of revenue over interest and expenses, | 42,512.91 |
| | $1,041,607.62 |

HOW THESE MEANS HAVE BEEN USED.

| | | |
|---|---|---|
| Water Works, cost, January 1st, 1861, | | $1,013,245.06 |
| Water pipes on hand, | $13,031.56 | |
| Coal on hand, | 5,019.24 | |
| Machinery, tools, etc., on hand, | 8,666.50 | |
| Water meters, $500, service-cocks, $186.42, | 686.42 | |
| Stop-cock, box-covers, etc., $75, office furniture, $157, | 232.00 | |
| | | 27,635.72 |
| Race, Mathews & Co., | | 11.60 |
| Orrington Lunt, Treasurer, balance on deposit with C. M. & F. Ins. Co., | | 715.24 |
| | | $1,041,607.62 |

The Board had occasion early in the year to apprise you officially of the death of Mr. Geo. W. Dole, whose name is identified with many of the most important enterprises of the city; and who for six years prior to his death was one of the Water Commissioners. He was so universally known and esteemed, that his death was properly considered as a public calamity. His long connection with this office is remembered only with pleasure, and as his associate and successors, we can hardly forbear in this Report this brief allusion to him. He was a faithful and efficient officer, having always the interests of the city at heart, with a delicate sense of true integrity which never allowed his private interests to interfere with his public trusts. Chicago has become all that it is during his residence here. He had a hand in creating its business and institutions, and its growth and welfare were matters of personal interests to him.

The Water Works now include and supply about all of the city. Probably as nearly all of the buildings of the city are reached and supplied by the pipes as will be possible at any time, so long as the city grows as fast as it has for the last ten years. Its over ninety miles of pipe reach the limits of the city southward, on the line of Cottage Grove Avenue; extend west of Union Park nearly a mile, and reach northward to the rolling mills and Center street. The business of the city, as well as the comfort and health of its inhabitants, is largely interested in the regular and efficient maintenance of the water supply. Hundreds of steam engines are at work, drawing their supply from the Works, and its railroads, machine shops and factories, hotels, printing offices, mills, breweries, and almost all of its business establishments, large and small, are served by and depend upon them.

The Water debt but little exceeds one million dollars, nearly all of which is a six per cent. loan. The income pays the interest, the operating expenses and repairs, and exceeds the interest and all expenses by an amount sufficient to extinguish the debt, if, year by year, this excess is applied to the purchase of the Water Loan Bonds at not over their seven per cent. par value, and is not used in paying for additions to the Works.

We append the Reports of the Treasurer and Superintendent, giving the details of their respective departments, and submit the usual yearly and half-yearly financial statements, numbered 1, 2, 3, and 4.

ORRINGTON LUNT,
EDWARD HAMILTON,
BENJAMIN CARPENTER,
*Board of Water Commissioners of the City of Chicago.*

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STATE OF ILLINOIS, }
COOK COUNTY, } ss.
CITY OF CHICAGO. }

I, JOHN FORSYTHE, a Notary Public in and for the City of Chicago, in the County and State aforesaid, do hereby certify that the above statement was duly sworn to before me, by the above named Commissioners, this fifth day of March, A. D. 1861.

JOHN FORSYTHE, *Notary Public.*

## STATEMENT NO. 1,

OF THE AFFAIRS OF THE CHICAGO CITY HYDRAULIC COMPANY, JANUARY 1ST, 1861.

*Debit.*

| | | |
|---|---|---|
| Water Works, their total cost, - - | $1,013,245.06 | |
| Operating expenses and repairs in full to date, - - - - - - - | 234,105.73 | |
| Interest on Bonds, including the coupon payments to July 1st, 1860, and all other interest to Dec. 31st, 1860, - | 302,620.45 | |
| Duncan, Sherman & Co., for the payment of coupons of this date, and all unpaid coupons of previous dates,—making with the above the total interest account, - - - - - - | 33,970.00 | |
| Discount on the six per cent. Bonds, - | 87,390.78 | |
| Water Pipes; for cast iron pipes on hand, | 13,031.56 | |
| Coal; for coal on hand, - - - | 5,019.24 | |
| Stock; for machinery, tools, &c., on hand, - - - - - - - - | 8,666.50 | |
| Water Meters; for water meters on hand, | 500.00 | |
| Service-cocks; for service-cocks on hand, | 186.42 | |
| Stop-cock boxes; for iron covers and frames on hand, - - - - | 75.00 | |
| Office furniture, - - - - - | 157.00 | |
| Race, Mathews & Co., - - - | 11.60 | |
| Orrington Lunt, Treasurer, balance in his hands, - - . - - - | 715.24 | |
| | | $1,699,694.58 |

*Credit.*

| | | |
|---|---|---|
| Water Loan Bonds (six per cent.) issued, | $1,030,000.00 | |
| Water Loan Bonds (seven per ct.) issued, | 56,000.00 | |
| Income, all Water Tax received, and profits tapping pipes, - - - | 613,209.09 | |
| Quintard & Whitney, am't due them, | 485.49 | |
| | | 1,699,694.58 |

## STATEMENT NO. 2.

RECEIPTS AND EXPENDITURES FROM JULY 1ST TO DECEMBER 31ST, 1860, INCLUSIVE.

## RECEIPTS.

| | |
|---|---|
| Water Tax, total receipts, - - - - - - - | $68,739.07 |
| Cash received for tapping the distributing pipes, - - | 898.00 |
| " " " shutting off and letting on water, 36.05; from a street sprinkler for injury to a fire hydrant, 5.89, | 41.94 |
| Cash received, P. & Ft. W. R. R., for work and materials laying pipe to cattle yard, - - - - - - | 174.72 |
| Cash received Chicago Refining Co., for laying pipe and putting up hydrant at Refinery, - - - - - - | 176.12 |
| Cash received, Ill. Central R. R., for laying pipe to depot, $155, less 103.25 paid Walworth, Hubbard & Co., | 51.75 |
| Cash received, P. & Ft. W. R. R., for sinking pipe along West Water street, - - - - - - - | 171.20 |
| Cash received, Gage, Brother & Drake, for laying pipe in alley by Tremont House, - - - - - - | 30.00 |
| Cash received, Colwell & Co., for amount by which bonds paid them exceeded their account, - - - | 113.69 |
| Cash received from sales railroad iron from S. Reservoir, $238.44; from pipe and old iron, $33.92, - - - | 272.36 |
| Cash received, Telegraph Co., for work at State st. pipe, | 9.50 |
| Cash received from sale of eastern bills and gold, - | 15.69 |
| Cash received, Sewerage Commissioners, for repairs of pipe, - - - - - - - - - - - - - | 60.78 |
| Total cash receipts, July 1st to December 31st, 1860, | $70,754.82 |
| Add balance in Treasurer's hands July 1st, - - - | 134.18 |
| Total cash receipts for the six months and balance on hand July 1st, - - - - - - - - - - - | 70,889.00 |
| 14 Water Loan Bonds issued during the six months, with accrued interest, - - - - - - - - - | 14,270.67 |
| Total receipts from all sources during the half year, - | 85,159.67 |

## EXPENDITURES.

| | |
|---|---|
| Water Tax refunded, from buildings being burnt, errors, &c., | 46.75 |
| Payments for tappers' services and expenses, including service-cocks on hand, | 588.76 |
| Payments for operating expenses, | 21,420.09 |
| Interest on Bonds, | 36,232.06 |
| Payments resulting from extension of water pipes, | 20,366.09 |
| Payments connected with new main, &c., | 89.75 |
| Water pipes on hand, increase since July 1st, | 162.16 |
| Coal on hand, " " " | 4,698.48 |
| Stock acc't.—For hydrants, lead, &c., on hand, more than on July 1st, | 215.00 |
| Colwell & Co., | 113.69 |
| Water meters on hand, | 500.00 |
| Race, Mathews & Co., | 11.60 |
| Total expenditures of cash and bonds during the half year ending December 31st, 1860, | $84,444.43 |
| Balance remaining in Treasurer's hands, Jan'y 1st, 1861, | 715.24 |
| | $85,159.67 |

## STATEMENT NO. 3.

RECEIPTS AND EXPENDITURES DURING THE YEAR ENDING DEC. 31, 1860.

## RECEIPTS.

| | |
|---|---|
| Water Rents and assessments, (including $77.00 from Sewerage Board, for water in 1859,) | $131,342.66 |
| Tapping pipes, gross receipts, | 1,499.00 |
| Shutting off and letting on water, and miscellaneous office receipts, | 65.96 |
| Received of City of Chicago for award on lot 16 block 17, Duncan's Addition, for opening alley in block, | 210.00 |
| Received of Sewerage Commissioners for changes and repairs of pipe, | 181.94 |
| Received of G. & C. U. R. R., for labor and materials changing hydrants, | 123.40 |
| Received of H. H. Magie, for sinking pipe cor. Lake and La Salle streets, | 23.69 |
| Received of Telegraph Co., for costs laying cable at State street river pipe, | 31.22 |
| Received of P. & Ft. W. R. R., for laying pipe to cattle yard, | 174.72 |
| Received of Chicago Refining Co., for laying pipe and hydrant at refinery, | 176.12 |
| Received of Ill. Central R. R., for laying pipe to depot, | 51.75 |
| Received of P. & Ft. W. R. R., for sinking pipe along West Water street, | 171.20 |
| Received of Gage, Bro. & Drake, for laying pipe in alley by Tremont House, | 30.00 |
| Received of Colwell & Co., for excess of bonds paid them over their account, | 113.69 |
| Received of street sprinkler, for repair of fire hydrant, | 5.89 |
| Received from sale of railroad iron from S. Reservoir, | 238.44 |
| Received from sale of pipe and old iron, $122.00; sale of insurance stock, $5.00, | 127.00 |
| Commissions, selling buildings, $3.09; premium on gold and eastern bills, $35.91, | 39.00 |
| | $134,605.68 |
| Balance in Treasurer's hands, January 1st, 1860, | 147.75 |

| | |
|---|---|
| Total cash on hand January 1st, 1860, and cash receipts during the year, | 134,753.43 |
| Water Loan Bonds issued during the year, (14 in No.,) | 14,270.67 |
| Total cash on hand, January 1st, 1860, cash receipts during the year, and proceeds of bonds issued during the year, | $149,024.10 |

## EXPENDITURES.

| | |
|---|---|
| Water Tax refunded by audited vouchers, | $102.93 |
| Tappers' services and expenses, including service-cocks on hand, | 1,159.44 |
| Payments for operating expenses and repairs, | 40,993.14 |
| Interest payments, | 69,453.73 |
| Extending the water pipes, payments by cash and bonds, | 21,266.69 |
| Payments for all additions besides the distributing water pipes, | 287.15 |
| Coal on hand, payments on during the year, | 1,792.20 |
| Water Meters, payments on same not included in operating expenses, | 500.00 |
| Stop-cock boxes, " " " " | 75.00 |
| Stock account, payments on same not included in operating expenses or additions during the year, | 289.00 |
| Colwell & Co., $113.69; Race, Mathews & Co., $11.60 | 125.29 |
| For the following matters reported due January 1st, 1860: | |
| Agreement Board Water Com., due April 1, 1860, | 10,000.00 |
| William E. Mortimer, | 716.25 |
| Mahlon McEntee and John McHugh, | 1,113.69 |
| C. Reissig & Co., | 434.35 |
| | $148,308.86 |
| Add in Treasurer's hands, January 1st, 1861, | 715.24 |
| | $149,024.10 |

## STATEMENT NO. 4.

This statement shows in detail the application of all expenditures by cash or bonds during the year 1860. It shows, besides, the *actual cost* during the year of all extensions, operating expenses and repairs, and interest,—the actual cost often varying from the amount of money paid out, from the use of materials previously paid for, and from other causes.

| EXTENDING THE WATER PIPES. | Expenditures by money or bonds. | Total expendit're money or bonds. | Total actual cost. |
|---|---|---|---|
| Cast iron pipes, nearly all 4 and 6 inch, | $15,374.11 | | |
| Trenching and backfilling, | 1,585.46 | | |
| Services of calkers, laborers, &c. testing and laying pipes and placing hydr'ts and stop-cocks | 1,904.22 | | |
| Stop-cocks and hydrants, and boxes for same, $601.38; hauling pipes, $179.40, | 780.78 | | |
| Lead, $1,487.26; Gasket, $25.36; Coal, $23.77, | 1,536.39 | | |
| Tools and repair'g same, $47.38; Plumbing at testing pres, $3.89, | 51.27 | | |
| Horse shoeing, $6.00; repairing wagons, 7.25; forage, $21.21, | 34.46 | | |
| | | $21,266.69 | |
| Add for actual cost: For pipe used in addition to that bought in 1860, $2,305.99 | | | $23,572.68 |

| ALL ITEMS CHARGED TO COST OF WATER WORKS NOT INCLUDED IN ABOVE. | | |
|---|---|---|
| Special assessment for opening alley in West Reservoir lot, | 172.40 | |
| Making lake soundings, with the view of extending inlet pipe further into the lake, | 76.00 | |
| Advertising and surveying for new main, | 38.75 | |
| | | 287.15 |

| | | | |
|---|---|---|---|
| Deduct for actual cost: | | | |
| Award received for opening alley in W. Reservoir lot, $210, | | | 77.15 |
| Total additions to the Works during 1860,—including all items charged to construction or Water Works account, - | | $21,553.84 | $23,649.83 |
| OPERATING EXPENSES. | | | |
| *Improvement Account.* (Charged to operating expenses for 1860:) | | | |
| Two new chimnies, together with such changes at the engine-house as were made necessary by their construction, . - | $2,344.01 | | |
| New smoke pipe connecting S. chimney and south boilers, - | 243.60 | | |
| | | $2,587.61 | $2,587.61 |
| OPERATING EXPENSES ENGINE HOUSE. | | | |
| Services of Engineer and two Assistant Engineers, - - | 2,670.04 | | |
| Services of firemen and laborers | 2,091.53 | | |
| Coal, 2,688 $\frac{856}{2000}$ tons, $9,888.90; Road to coal sheds, $36.09, - | 9,924.99 | | |
| Oil, 313 galls., $281.70; Tallow, 1,288 lbs., $140.23; Cotton waste, $52.75; - - - | 474.68 | | |
| Packing, $36.20; Gas, $293.75, | 329.95 | | |
| Repairs of North Boiler, and incidental expenses connected with it, - - - - - | 1,317.29 | | |
| Felting North Boiler, - - | 190.56 | | |
| Repairs South Boiler, $29.08; Iron doors South Boiler room, $40.95, - - - - - | 70.03 | | |
| Repairing pump valves, $126.85; suction pipe well engine, 22.23, | 149.08 | | |
| Freight of new piston, - - | 9.69 | | |
| Carried forward, - - | | $2,587.61 | $2,587.61 |

| | | | |
|---|---|---|---|
| Amounts brought forward, - | $17,227,84 | $2,587.61 | $2,587.61 |
| Smoke burning experiment, - | 113.05 | | |
| Furniture and other matters for Engineer's office, $32.04; Ice, $8.00, - - - - - - | 40.04 | | |
| Repairing walls of tower and engine house, $88.00; paints and glazing, $30.35, - - | 118.35 | | |
| Tools and miscellaneous hardware, $40.22; Blacksmithing, $19.06, - - - - - - | 59.28 | | |
| Coal Car, $54.80; miscellaneous, $52.95, - - - - - | 107.75 | | |
| | | 17,666.31 | |
| Add due Quintard & Whitney: | | | |
| For duplicate carrying arm new engine, - $50.61 | | | |
| For new piston complete for old engine, - - 382.50 | | | |
| For 6 valves and 12 stems for new engine, - 52.38 | | | |
| $485.49 | | | |
| Deduct for old iron sold 42.63 | | | |
| $442.86 | | | 18,109.17 |
| MISCELLANEOUS REPAIRS AND OPERATING EXPENSES. | | | |
| Services of calkers, laborers, carpenters, and others, for repairs and operating, - - - | 3,302.73 | | |
| Repairs of Reservoirs, $56.67; Watchmen for Res., $157.00, | 213.67 | | |
| Wire screens for inlet pipe 47.08; Man-holes for do., $34.63; - | 81.71 | | |
| Repairing hydrant and stop-cocks, $202.76; hydrant and stop-cock boxes, $274.80; hydrants and stop-cocks, $335.50 | 813.06 | | |
| Amounts carried forward, - | $4,411,17 | $20,253,92 | $20,696,78 |

| | | | |
|---|---|---|---|
| Amounts brought forward, - | $4,411.17 | $20,253.92 | $20,696,78 |
| Water pipes,$647.46; lead,$149.-50; coal, $18.85; gasket, $2.34, | 818.15 | | |
| Blacksmithing, repairs of tools, &c., $101.83; plumbing, 36.07 | 137.90 | | |
| Horse feed, $351.91; horse shoeing, $32.02; harness, $11.41; repair of buggy and cutter, $23.50; horse doctoring, $5, | 423.84 | | |
| Hauling manure to bank hyd'ts, $15; salt for thawing hyd'ts, $19.80, - - - - - | 34.80 | | |
| Assessment for widening and extending Chicago Avenue, $163.98: assessment for paving South Clark st., $49.99, | 213.97 | | |
| Publishing Annual Report, - | 80.40 | | |
| Repairs of paving, $34.60; miscellaneous for stock accouut, $140.00, - - - - | 174.60 | | |
| Water meters, - - - - | 309.30 | | |
| Hardware, $20.03; rope, $7.28; miscellaneous, $108.10, - | 135.41 | | |
| | | 6,739.54 | |
| Deduct for actual cost: | | | |
| Received sale of boiler iron, $4; insurance stock, $5; railroad iron, S. Res., $238.44, - - | $247.44 | | |
| Charged Sewerage Com. for repairs, 1860, $87.44; Rec'd of sundry parties for work done and materials used, as follows: Shutting off and letting on water, $65.96; Magie & High, $23.69; G. & C. U. R. R., $123.40; Teleg. Co., $31.22; Ill. Cent. R. R., $51.75; P. & Ft. W. R. R., $345.92; street sprinkler, for repair fire hyd't, $5.89; Chicago Refining Co., | | | |
| Amount carried forward, - | $247.44 | $26,993.46 | $20,696.78 |

| | | | |
|---|---|---|---|
| Amount brought forward, - | $247.44 | $26,993.46 | $20,696.78 |
| $176.12; Gage, Bro. & Drake, | | | |
| $30.00; - - - - - | 941.39 | | |
| | 1,188.83 | | 5,550.71 |
| OPERATING EXPENSES—OFFICE. | | | |
| Office rent, - - - - - | 1,200.00 | | |
| Services of clerks, - - - | 2,292.60 | | |
| Services of collectors, $2,116.27; | | | |
| inspector & collector, 1,000.08; | 3,116.35 | | |
| Labor care of office, &c., - - | 236.50 | | |
| Stationery, $80.06; Atlas of the | | | |
| city, $262.80, - - - - | 342.86 | | |
| Printing water bills, permits, | | | |
| &c., $193.25; tax books, $55, | 248.25 | | |
| Advertising May and November | | | |
| Water Tax, $89.55; newspa- | | | |
| pers, $21, - - - - - | 110.55 | | |
| Gas, $16.75; ice, $11.00; coal, | | | |
| $23.01; stoves and furniture, | | | |
| $19.17, - - - - - | 69.93 | | |
| Miscellaneous petty payments, | 59.31 | | |
| Horse feed, $55.16; horse shoe- | | | |
| ing, $19.07; buggy and repair- | | | |
| ing same, $63, - - - | 137.23 | | |
| | | 7,813.58 | |
| Deduct for actual cost: | | | |
| Commissions receiv'd for selling | | | |
| buildings, - - 3.09 | | | 7,810.49 |
| OPERATING EXPENSES—SALARIES. | | | |
| Services of Water Commiss'rs, | 2,886.10 | | |
| " " Superintendent, - | 1,800.00 | | |
| " " Secretary, - - | 1,500.00 | 6,186.10 | 6,186.10 |
| Total operating expenses and | | | |
| repairs, 1860, - - - | | $40,993.14 | $40,244.08 |
| INTEREST. | | | |
| Interest, July 1, 1860, $32,370; | | | |
| Do. Jan'y 1, 1861, $32.860, | 65,230.00 | | |
| Amount carried forward, - - | $65,230.00 | | |

| | | | | |
|---|---|---|---|---|
| Amount brought forward, - | | $65,230.00 | | |
| Exchange on July and Jan. int., | | 3,731.08 | | |
| Commissions p'd Duncan, Sherman & Co. for payment of Jan'y and July, 1860, interest, | | 172.59 | | |
| Interest on temporary loan, - | | 320.06 | | |
| | | | $69,453.73 | |
| Add for actual cost: | | | | |
| Amount charged over to interest from discount acc't, July 1st, 1860, and Jan. 1, '61, | 2,327.76 | | | |
| Deduct for actual cost: | | | | |
| Premium rec'd on gold and east. bills, 35.91 | | | | |
| Accrued interest rec'd on bonds paid out, 270.67, - - - | 306.58 | | | |
| | 2,021.18 | | | |
| | | | | 71,474.91 |
| Total interest, 1860, - - | | | $69,453.73 | $71,474.91 |
| Total operating expenses and repairs, 1860, bro't forward, | | | 40,993.14 | 40,244.08 |
| Total additions to the Works, 1860, brought forward, - | | | 21,553.84 | 23,649.83 |
| | | | $132.000.71 | $135,368.82 |
| SERVICE-COCKS. | | | | |
| Tappers' services, - - - | | $409.67 | | |
| Service-cocks, - - - - | | 559.01 | | |
| Cast iron boxes and covers 94.68; miscellaneous, 2,50, - - | | 97.18 | | |
| Repair of wagon, 51.25; repair of harness, 8.85, - - - | | 60.10 | | |
| Horse feed, 8.35; repairs of tappers' tools, 25.13, - - - | | 33.48 | 1,159.44 | |
| Amount carried forward, - - | | | $133,160.15 | |

| | | |
|---|---|---|
| Amount brought forward, - | | $133,160.15 |
| Add for actual cost: | | |
| Service-cocks used previously paid for, - | 152.37 | |
| Deduct receipts for tapping pipes, $1499; cocks on h'd, $186.42, | 1,685.42 | |
| | 1,533.05 | |
| Showing a profit of - | 373.61 | |
| Stock acc't, increase during the year, - - - - - | | 289.00 |
| Coal acc't, on hand and paid for during the year, - - - | | 1,792.20 |
| Colwell & Co., - - - | | 113.69 |
| Water meters, 809.30, less 309.30 charged operating expenses, | | 500.00 |
| Stop-cock boxes on hand and paid for during the year, - | | 75.00 |
| Water Tax paid back by audited vouchers, - - - - | | 102.93 |
| Race, Mathews & Co., for fr'ht of hydrants, - - - - | | 11.60 |
| Matters outstanding Jan. 1st, 1860, and paid during the year, viz: | | |
| Agreement of Board due April 1st, 1860, - - - - | | 10,000.00 |
| Wm. E. Mortimer, - - - | | 716.25 |
| Mahlon McEntee and John McHugh, - - - - - | | 1,113.69 |
| C. Reissig & Co., - - - | | 434.35 |
| Total of money and bonds expended by Chicago City Hydraulic Company during the year 1860, - - - - - - | | $148,308.86 |

# Treasurer's Report.

## BOARD OF WATER COMMISSIONERS

OF THE CITY OF CHICAGO,

1860. **In account with ORRINGTON LUNT, Treasurer.** CREDIT.

| | | | |
|---|---|---|---|
| July 1 | By balance on hand, - - - - | | $ 134,18 |
| 12 | By rec'd of A. W. T., Sec., Water Rents collected, - | $1,926.66 | |
| 16 | " " " " " | 551.50 | |
| 19 | " " " " " | 876.25 | |
| 23 | " " " " " | 583.90 | |
| 26 | By rec'd of A. W. T., Sec,, Water Rents collected, $650.53, tapping rec'ts, $100.00; sale old iron, $7.97 - | 758.50 | |
| 28 | By rec'd of A. W. T., Sec,, Water Rents collected, $333.00, P. & Ft. W. R. R., for laying pipe at cattle yard $174.72 - - - - - | 507.72 | |
| | | | 5,204.53 |
| Aug. 2 | By rec'd of A. W. T., Sec., Water Rents collected | 1,234.86 | |
| 6 | " " " " " | 466.54 | |
| 10 | " " " " " | 750.92 | |
| 14 | " " " " " | 640.10 | |
| 17 | By rec'd of A. W. T., Sec., Water Rents collected, $407.95, tapping rec'ts, $100.00 - - - - - | 507.95 | |
| 22 | By rec'd of A. W. T., Sec., Water Rents collected | 781.85 | |
| 27 | " " " " " | 782.85 | |
| 31 | By rec'd of A. W. T., Sec., Water Rents collected, $953.30, tapping rece'ts, $100,00 - - - - - | 1,053.30 | |
| | | | 6,218.37 |
| Sept. 5 | By rec'd of A. W. T., Sec., Water Rents collected | 992.84 | |
| 8 | By rec'd of A. W. T., Sec., Water Rents collected, 636.27, rep. of hyd't, 5.89 | 642.16 | |
| | Carried forward - - - - | $1,635.00 | $11,557.08 |

## ACCOUNT CONTINUED.

| | | | |
|---|---|---|---|
| 1860. | Amount brought forward - - - | $1,635.00 | $11,557.08 |
| Sep. 13 | By rec'd of A. W. T., Sec., Water Rents collected, $798.59, tap. rec'ts, $100 | 898.59 | |
| 19 | By rec'd of A. W. T., Sec., Water Rents collected - - - - - | 718.29 | |
| 22 | By rec'd of A. W. T., Sec., Water Rents collected, 338, Refining Co., 176.12 | 514.12 | |
| 27 | By rec'd of A. W. T., Sec., Water Rents collected - - - - - | 432.70 | |
| | | | 4,198.70 |
| Oct. 4 | By rec'd of A. W. T., Sec., Water Rents collected, 1,114.89, tap. rec'ts, $100 | 1,214.89 | |
| 6 | By rec'd of A. W. T., Sec., Water Rents $327.70, sale railroad iron, $238.44 | 566.14 | |
| 13 | By rec'd of A. W. T., Sec., Water Rents collected | 757.50 | |
| 18 | " " " " " | 549.87 | |
| 20 | " " " " " | 301.50 | |
| 24 | By rec'd of A. W. T., Sec., Water Rents collected, $478, tapping rec'ts, $100 | 578.00 | |
| 29 | By rec'd of A. W. T., Sec., Water Rents collected | 620.21 | |
| 31 | " " " " " | 717.00 | |
| | | | 5,305.11 |
| Nov. 2 | By rec'd of A. W. T., Sec., Water Rents collected, $966.13, tap. rec'ts, $100.00 | 1,066.13 | |
| 3 | By rec'd of A. W. T., Sec., Water Rents collected | 829.38 | |
| 5 | " " " " " | 885.43 | |
| 7 | By rec'd of A. W. T., Sec., Water Rents collected, 1,199.92, sales pipe, 18.48 | 1,218.40 | |
| 9 | By rec'd of A. W. T., Sec., Water Rents collected | 1,034.50 | |
| 10 | " " " " " | 651.75 | |
| 13 | " " " " " | 1,448.50 | |
| 14 | " " " " " | 571.81 | |
| 15 | " " " " " | 892.06 | |
| 16 | " " " " " | 1,029.50 | |
| 19 | " " " " " | 1,285.50 | |
| 20 | By rec'd of A. W. T., Sec., Water Rents collected, $1,638.07, do. $912.00 | 2,550.07 | |
| 21 | By rec'd of A. W. T., Sec., Water Rents collected | 1,340.93 | |
| 22 | " " " " " | 1,131.70 | |
| | Carried forward - - - | $15,935.66 | $21,060.89 |

## ACCOUNT CONTINUED.

| | | | |
|---|---|---|---|
| 1858. | Amount brought forward - - - | $15,935.66 | $21,060.89 |
| 23 | By rec'd of A. W. T., Sec., Water Rents collected - - - - - | $1,524.75 | |
| 24 | By rec'd of A. W. T., Sec., Water Rents collected, $900.90, tap. rec'ts, $100 | 1,000.90 | |
| 26 | By rec'd of A. W. T., Sec., Water Rents collected | 1,496.13 | |
| 27 | " " " " " | 1,932.21 | |
| 28 | " " " " " | 1,374.10 | |
| 30 | " " " " " | 2,391.29 | |
| | | | 25,655.04 |
| Dec. 1 | " " " " " | 4,762.25 | |
| 3 | " " " " " | 2,431.89 | |
| 4 | " " " " " | 1,478.54 | |
| 5 | " " " " " | 946.55 | |
| 6 | " " " " " | 1,043.58 | |
| 7 | " " " " " | 1,100.05 | |
| 8 | " " " " " | 1,164.40 | |
| 10 | " " " " " | 748.10 | |
| 11 | " " " " " | 692.89 | |
| 12 | " " " " " | 638.56 | |
| 14 | " " " " " | 968.24 | |
| 15 | " " " " " | 494.85 | |
| 17 | " " " " " | 664.95 | |
| 19 | " " " " " | 503.86 | |
| 21 | " " " " " | 1,057.51 | |
| 22 | " " " " " | 506.55 | |
| 24 | " " " " " | 1,148.08 | |
| 27 | By rec'd of A. W. T., Sec., Water Rents collected, $146.11, Gage, Bro. & Drake, $30.00, Ill. Cen. R. R. Co., $51.75, ($155.00, less $103.25 paid Walworth, Hubbard & Co.,) P. & Ft. W. R. R. Co., $171.20, Colwell & Co., $113.69, pipe sold, $7.47 | 520.22 | |
| 29 | By rec'd of A. W. T., Sec., Water Rents collected - - - - - | 426.73 | |
| 31 | By rec'd of A. W. T., Sec., Water Rents collected, $2,655.25, tap. receipts, $98.00, shutting off and letting on water, &c., $36.05, Telegraph Co. for work at State street pipe, $9.50, premium rec'd on gold and eastern money sold, $15.69, rec'd Sewerage Com., for repairs of pipe, 60.78 | 2,875.27 | 24,173.07 |
| | | | $70,889.00 |

## ACCOUNT CONTINUED.

| 1860. | | | | | | Debit. |
|---|---|---|---|---|---|---|
| July 31 | For am't paid on warrants No 1–26 of A. W. Tinkham, Sec'y | | | | 5,524.74 | |
| Aug 31 | " | " | " | 27–72 " | 5,178.19 | |
| Sep 30 | " | " | " | 73–110 " | 5,361.85 | |
| Oct 31 | " | " | " | 111–146 " | 5,901.51 | |
| Nov 30 | " | " | " | 147–189 " | 6,650.16 | |
| Dec 31 | " | " | " | 190–284 " | 41,557.31 | |
| | | | | | | $70,173.76 |
| | Balance on hand credited in new acc't | | | | | 715.24 |
| | | | | | | $70,889.00 |
| 1861. | Credit. | | | | | |
| Jan'y 1 | By balance on hand deposited with Chicago Marine and Fire Ins. Co. | | | | | 715.24 |

ORRINGTON LUNT,
*Treasurer.*

# REPORT

OF

# E. S. CHESBROUGH, C. E.,

ON THE MATTERS SUBMITTED TO HIM BY THE RESOLUTION OF THE BOARD, OF MARCH 7TH, 1860.

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OFFICE SEWERAGE COMMISSIONERS,
Chicago, Feb. 25, 1861.

*To the Board of Water Commissioners:*

GENTLEMEN: In compliance with your request of March 7th, I have, as opportunity has offered, collected information relative to the subject, and made such surveys as seemed necessary. As your necessities did not require an earlier answer, and my duties under the Board of Sewerage Commissioners did not leave me sufficient leisure to make it, this Report has been delayed much longer than was expected; besides, some information herewith presented could not be obtained much earlier.

With regard to "*extending the inlet pipe so far out into the lake that the water thus obtained shall be free both from the wash of the lake shore and the flow of the river,*" there is much room for diversity of opinion as to the mode and cost of doing it.

It has been proposed to *lay a wrought iron pipe*, five feet in diameter, one-quarter of an inch thick, one mile in length, and with flexible joints one thousand feet apart.

One question that arises immediately in the discussion of this subject is, what amount of daily supply should be provided for? It is very evident that what was more than enough three years ago, is totally inadequate now; and there is every reason to believe that the present supply will soon prove insufficient. But if we provide a supply for a time too far distant, the loss of interest on the present and proximately future unnecessary portions of the work would alone pay for the construction of new works. As no rule whatever can be relied upon to determine the future population, or demand for water of a city, something, in a case of this kind, must be assumed. It is

therefore supposed that ten years would be a suitable time to provide for, and that at the end of that period, the population and water consumption of Chicago will both be doubled. In this connection, the following tabular statement, giving the experience of other cities as well as our own, will be of interest.

AVERAGE NUMBER OF WINE GALLONS SUPPLIED DAILY BY DIFFERENT WATER WORKS.

| | Fairmount, Philadelphia | Boston. | Cincinnati. | Buffalo. | Cleveland. | Detroit. | Chicago. |
|---|---|---|---|---|---|---|---|
| 1830 | 2,466,909 | | | | | | |
| 1831 | 2,964,285 | | | | | | |
| 1832 | 3,662,580 | | | | | | |
| 1833 | 4,014,046 | | | | | | |
| 1834 | 4,150,771 | | | | | | |
| 1835 | 4,107,462 | | | | | | |
| 1836 | 4,178,317 | | | | | | |
| 1837 | 4,219,475 | | | | | | |
| 1838 | 4,700,793 | | | | | | |
| 1839 | 4,856,688 | | | | | | |
| 1840 | 4,925,409 | | | | | | |
| 1841 | 5,427,137 | | | | | | |
| 1842 | 5,245,831 | | | | | | |
| 1843 | 5,398,765 | | | | | | |
| 1844 | 6,507,300 | | | | | | |
| 1845 | 5,026,639 | | | | | | |
| 1846 | 4,264,127 | | | | | | |
| 1847 | 4,975,518 | | | | | | |
| 1848 | 5,219,506 | | | | | | |
| 1849 | 5,397,308 | | | | | | |
| 1850 | 5,841,851 | 5,837,900 | | | | | |
| 1851 | 6,947,127 | 6,883,800 | | | | | |
| 1852 | 6,997,177 | 8,125,800 | | | | 963,022 | |
| 1853 | 7,607,175 | 8,542,300 | | | | 831,594 | |
| 1854 | 7,647,105 | 9,902,000 | | 880,301 | | 1,030,863 | |
| 1855 | 7,611,756 | 10,346,300 | | 1,046,599 | | 1,487,143 | |
| 1856 | | 12,048,600 | | 1,565,622 | | 1,891,050 | |
| 1857 | | 12,726,000 | 4,587,221 | 2,037,713 | 348,664 | 1,909,837 | |
| 1858 | 8,379,229 | 12,847,000 | | 2,557,940 | 389,467 | 1,981,071 | 2,991,412 |
| 1859 | 9,228,415 | 13,175,000 | 4,618,567 | 3,311,700 | 588,252 | 2,142,774 | 3,877,117 |
| 1860 | 9,871,549 | 17,238,000 | 5,000,000 | 4,000,000 | | | 4,690,673 |

Much of the increase shown in the foregoing table is owing to the extension of works as well as to the growth of population; but there is also another cause of increased consumption, and that is the growing use of water closets and private baths, the greater watering of streets, the flushing of sewers, the increase of manufacturing establishments, and the playing of public and private fountains, when they can be indulged in. The greater or less use of water for these purposes will account very much for the great difference there is with regard to the

average rate of consumption per inhabitant in different cities, which difference will be seen in the following statement of the

DAILY AVERAGE NUMBER OF WINE GALLONS OF WATER SUPPLIED TO DIFFERENT CITIES.

| Name of City. | Date. | Popula'n | Gals. suppl'd | Av. pr inhab't | Authority, | Remarks. |
|---|---|---|---|---|---|---|
| New York, .. | 1860 | 814,277 | 42,000,000 | 51.6 | A. W. Craven, | Consumption estimated occasionally only. |
| Philadelphia, | " | 568,034 | 20,398,197 | 35.9 | H. P. M. Birkinbine | |
| Baltimore, ... | " | | | 25 | Jas. S. Suter. | do do |
| Boston,..... | " | 177,902 | 17,238,000 | 96.9 | James Slade. | Probably not more than 100,000 of the pop. take the water. One sugar refinery is estimated to use 1,000,000 gallons daily. |
| St. Louis,.... | " | 162,179 | 6,500,000 | 40.1 | Fr. J. Homer. | |
| Cincinnati,... | " | 160,060 | | 30 | R. C. Phillips. | Only about one-half the popnlat'n take the water |
| Chicago, .... | " | 109,420 | 4,690,673 | 42.9 | B. F. Walker. | |
| Buffalo, ..... | " | 84,000 | 4,000,000 | 47.6 | A. R. Ketcham. | Some back leak'ge at p'mp valves discovered. |
| Washington } Georgetown, } | " | 69,855 | 1,350,000 | 19.3 | J. St. C. Morton. | Distribution not sufficient in 1860. Consumption in '61 will no doubt increase considerably. |
| Albany,..... | Oct '57 | | | 69 | Geo. W. Carpenter | |
| Detroit,..... | 1859 | | | 30.5 | Jacob Houghton. | |
| Jersey City, } Hoboken,...} | 1860 | 39,000 | 2,005,981 | 51.4 | Geo. H. Bailey and Robt. C. Bacot. | |

It is evident from the above statement that no rule for estimating the amount of water required for any city can be based simply upon its population. In fact the causes of consumption and waste are so numerous and variable that estimates of them have rarely, if ever, been approximately realized. With regard to waste, it has become so enormous in most cities, having a water supply, as to be a cause of universal complaint. This seems to be an incurable evil, for even in London, where the police system is so perfect, and the citizens are supplied by private companies having every incentive to prevent waste, it was asserted before the Institution of Civil Engineers, March 29th, 1859, "that at least two-thirds of the supply was lost," enumerating among sources of loss, "*leaky mains.*"

It is much to be feared that this cause of loss, leaky mains, is far more important than most persons suppose and in some respects the most difficult of all to detect and to remove. Last summer it was necessary while building sewers in this city, to remove the earth from a great many water pipes, when quite a number of leaks were discovered, none of which had been suspected before. Scarcely one of them would, if known, have been considered of sufficient importance to cause the breaking up of a pavement, to repair it, but the effect of a great many such must be a serious matter. Now if this state of things may exist in this city, with an unusually favorable soil for causing leaks to show themselves at the surface, what must be the

case in those cities where pipes are laid on gravel, broken stone or other loose or open materials, and near or on wharves, parts of which are solid and parts yielding? This is a subject of great importance, not only to those cities which are already threatened with a short supply, but to those which are either commencing new, or extending old works; but to pursue it further here would be foreign to the object of this report.

The actual daily average quantity of water supplied per inhabitant, very rarely, if ever, diminishes in a city. Frequently it appears to remain nearly stationary from year to year; but sometimes it increases very much. In London it was reported to be 19 wine gallons in 1828, and 37 in 1856. In Boston, 64 gallons in 1853, 76 in 1857, and 97 in 1860. But the most enormous amount yet reported is that of ancient Rome, 50 cubic feet or about 375 wine gallons. (*See Hughes' Water Works, p.* 9.)

The average daily consumption of Chicago for 1860 amounts to nearly 5,000,000 gallons, But there were some days in July last, when it reached nearly 7,000,000 gallons. Twice these quantities would be respectively 10,000,000 and 14,000,000 gallons, and for these it is proposed to provide a future supply.

A 5 foot iron pipe one mile long would deliver 14,000,000 gallons in 24 hours under a head of 0.8 feet. But the water would not be consumed uniformly throughout the 24 hours. It is usually considered safer to estimate the required head as if it had to be all delivered in 16 hours, which in this case would 1.8 ft. It is evident therefore the proposed 5 ft. pipe would be abundantly large.

The estimated cost of this pipe by the gentleman who proposed it, is as follows:

| | |
|---|---|
| 5280 lin. ft. of pipe, weight 184 lbs per ft., or 971,520 lbs. at 6 cts. - - - - | $58,291.20 |
| 5 joints at $200, - - - - - - | 1,000.00 |
| Bulkhead, - - - - - - | 1,500.00 |
| Laying the pipe, - - - - - - | 5,000.00 |
| | $65,791.20 |

As there appears to be no recorded experience of a successful or unsuccessful attempt to lay a similar pipe, it is impossible to speak confidently with regard to the sufficiency of the above estimate. If the experience of Cleveland in laying about 300 ft. of inlet pipe into the lake, that of Boston in laying a flexible pipe across Chelsea creek;

and that of Boston and Chicago in putting down syphons across navigable channels, be taken as guides, then the above estimate is far too small.

According to notes furnished me by W. S. Whitwell, Esq., under whose direction as Chief Engineer the work was done, the cost of the Chelsea Cr. flexible pipe was about $12.37 per lin. ft., not including the cost of metal. At this rate a mile of pipe would cost $65,316.60. But the Chelsea Cr. pipe had a flexible joint every 13 ft. to fit it to the shape of a very uneven and somewhat yielding bottom. It was only 20 in. in diameter however.

The inlet pipe at Cleveland is 300 ft. long, 50 in. in diameter, and made of 3-8 in. wrought iron. The following is a statement of its cost taken from a report of the Chief Engineer, T. R. Scowden, Esq., published in 1856:

| | |
|---|---|
| Inlet pipe, wrought iron, 79,078 lbs. at 8¾ cts. | $6,919.32 |
| Dredging trench in to lay inlet pipe, 3500 cub. yds. at 45 cts. | 1,575.00 |
| Driving 300 piles, at $5, | 1,500.00 |
| Stone fitting between piles, 287 yds. $5, | 1,435.00 |
| Timbering and plank for tower, 5,194, $2, | 103.68 |
| Cast rim and cover for same and stays 2500 lbs. at 4 cts., | 100.00 |
| Wrought fastenings, 1350 lbs. at 10 cts. | 135.00 |
| Expenses of laying inlet pipe in lake, | 450.00 |
| Carpentry and labor, | 350.00 |
| Frame and strainer over inlet, | 275.56 |
| Paving, masonry and water lime, | 210.00 |
| Expense of coffer dam and pumping, | 550.00 |
| | $13,603.56 |

Several of the above items would not be required, and prices for others are too high for the present; but admiiting that the above amount should be cut down $7,000, or but little more than one-half, as a basis for the Chicago pipe, its cost would then be $123,200.

The State St. syphon in this city, for a distance of about 300 feet cost $5,561, $3,561 for the pipe, and $2,000 for the dredging, sinking and backfilling. It is but 30 in. in diameter, has no flexible joints, and was laid in still water where no precautions were necessary against storms. At the above rate, one mile of pipe would cost $97,873,60.

It is true there were expenditures for curves at the ends of this pipe, which would not be required proportionally often on a long straight one, nor would any backfilling be necessary on the latter, and probably much less dredging in proportion; but on the other hand, it should be remembered that the State St. pipe is only half the diameter of the one proposed for the lake.

The cost of the Boston syphons was more than three times as great, in proportion to length, as the one at State street, but they were made of heavy cast iron, and encased in strong timber boxes which were lined with masonry and cement around the pipes, to protect them from the action of salt water.

The inlet pipe of the Detroit Works is 30 inches diameter and 327 feet long, extending from their engine to a point 150 feet beyond the wharf line, to 34 feet depth of water. It cost, when laid, $9,370. The laying of it was attended with considerable difficulty, on the shore as well as in the water, and the part in the river is protected from the dragging of anchors by piles and rubble stones. The result of laying this pipe, with regard to improving the supply, appears to have been very satisfactory. (*See Report of Jacob Houghton, Esq., Chief Engineer, for* 1858.)

The expansion and contraction in a wrought iron pipe one mile long, due to 30 degrees of temperature, is a little over one foot. This would have to be provided for in some way, for an opening one-sixteenth of an inch wide in the pipe would let in sand very rapidly.

It would be necessary to dredge, also, sufficiently to place the pipe below the bottom of the lake, at least far enough out to prevent the keels of vessels from striking in the heaviest storms. The cost of dredging in still water may be easily estimated; but the difficulty of keeping a trench open on the lake shore is so well known that no one would be likely to undertake it by the cubic yard, if only the trench, when finally completed, was measured.

No allowance was made by the projector of this pipe for pile work to steady it during the operation of sinking, because it was thought advantage might be taken of fine weather in summer, when the lake is sometimes quite calm for two or three days together. While it is possible the dredging and the sinking of the pipe might be completed during a single calm, the probability is that several attempts would have to be made, before meeting with complete success. This is on the supposition that the whole pipe could be put together somewhere, and towed to its position for sinking. It could only be put together

on the lake shore, for such a pipe, with joints 1,000 feet apart, could not be towed out of the river, on account of the bends in the latter. If the joints were put much nearer together, say 250 feet apart, such a pipe would be an insufferable obstruction to navigation. If put together on the lake shore, it would have to be placed out of the reach of storms, and launched from ways like a ship at the proper time. If a storm should arise after launching it, what could prevent the pipe from being injured, perhaps fatally?

If, to avoid this, the attempt should be made to lay the pipe in sections, the joints could not be put together on the lake without the aid of pile work, unless the surface of the lake should be smoother than could reasonably be expected. In view, then, of the above mentioned difficulties and risks, and of the want of experience with regard to meeting them, it seems to me that, instead of feeling satisfied that such a pipe, one mile in length, could be successfully laid for less than $66,000, it is not certain that twice this sum would be sufficient. It is possible, however, that responsible parties could be found who would undertake to do it for something like $100,000. If, however, it was laid, there is reason to fear it would sooner or later be injured by the dragging of anchors, as was the first syphon at State street.

To avoid the various risks and uncertainties attendant upon the laying and maintaining of the proposed pipe, it has been thought *a tunnel* might be made.

If the clay formation which is known to exist on the shore, continues under the lake, and soundings indicate that it does, then it would be quite feasible to make a tunnel as a substitute for the pipe.

With three shafts, one at each end, and one in the middle, with the moderate progress for clay ground of 4 ft. a day at each face, such a tunnel could be made in less than 13 months after sinking the shafts. It is proposed to protect the outer shaft by a hollow crib equal in weight to one 50 ft. square which, according to experience on this lake shore, would be immovable. The middle shaft could be protected in the same way.

It is proposed to make this tunnel circular, with a clear diameter of 6 ft., and to line it with brick work 12 in. thick—the inner ring 4 in. thick, to be laid in pure cement, and the others in mortar made of equal parts of cement and sand. The cost of masonry in the tunnels

on the Boston Water Works, laid under more unfavorable circumstances than would probably be met with here, was $13.35 per cubic yard, including not only all expenses of materials and labor, but of pumping, lights, and all other incidentals. But for this tunnel the estimate will be $15.00 a cubic yard, or $25 a thousand of brick laid for masonry, and $2.50 a cubic yard for earth work. The probable cost would then be:

| | |
|---|---|
| For 10,560 cub. yds. earth excavation, at $2.50, - - | $26,400 |
| " 3,960 " masonry " 15. - - | 59,400 |
| " outer shaft, - - - - - - - - - | 20,000 |
| " middle " - - - - - - - - | 15,000 |
| " inner " - - - - - - - - - | 5,200 |
| | $126,000 |

Should a tunnel be made, or a pipe successfully laid, what is to prevent either of them from silting up? An arrangement might be made to prevent this, by occasionally pumping through either of them four or five times the usual quantity of water, under a very small head at the pumping works, and then wasting it. But this would be an operation likely to be forgotten or neglected, especially if it should be considered useless by those in charge of the Works.

Should a point a mile out be successfully reached, is it certain that the full object the Commissioners have in view would be attained? Judging from what Capt. Prindeville, who is known to be so well acquainted with the entrance to our harbor, says, it is to be feared not. He thinks that in ordinary storms the water of the lake is turbid five miles out, and in extraordinary ones, fifteen miles out. So far as obtaining clear water at all times is concerned, it appears to be quite evident that the open lake is not to be relied upon at the distance of only one mile. That it would generally be freer from the wash of the shore than a point much nearer the Works, is exceedingly probable, but that the difference would justify so large an outlay, is a matter of great doubt.

Impurities from the river would be more likely to affect the water a mile out from the pumping station than near the shore, because the prevailing winds are from the northeast, and the currents of this side of the lake strongly southward, as the character of the newly formed beach north of the north pier shows.

It has been proposed *to erect new pumping works as far north as Winetka*, (16 miles,) where the shore rises 80 feet above the lake, thus affording an opportunity of constructing a very large and elevated reservoir, at a comparatively moderate cost. The same difficulty exists there, however, with regard to the turbidness of the lake water near the shore, during and after storms; the only advantage in quality of water being a much greater distance from the influence of the river and the city. To make use of this advantage it would be necessary, not only to construct the proposed reservoir and new pumping works, but to lay down two lines of 3 ft. pipes, a distance of 16 miles, at a probable cost of $1,689,600, or $10 per foot, for pipe.

Two lines of pipe are mentioned, not because it would not be cheaper to lay down a single one of sufficient capacity, but because it would not be safe to permit a city like this, with no large reservoirs within or near its limits, to be wholly dependent upon one line of pipe of so great a length. With all the precaution that can be used, pipes are liable to burst, or the joints to be blown out, injuries which might cause the city to be deprived of water for twenty-four hours or more. Should such an accident occur at the same time with a destructive fire, the consequences might be disastrous beyond the whole cost of the Water Works. The difference in cost between a single and a double line of pipes would be about $422,400, supposing the single line to be 4 feet in diameter, and to cost $15 a foot. By estimate, the large pipe, when new, would discharge, under a head of 20 feet, in 15 miles, a little over 12,000,000 gallons a day, and the two smaller ones a very little less than that amount. After being in use a few years, they would probably become coated with tubercles, and discharge but little, if any, more than 10,000,000 gallons a day.

In order to obtain pure and clear water at all times, it is proposed *to construct a filter bed* at the east end of the lot on which the present pumping works stand.

Such filter beds as it would be practicable to make and maintain for the use of a large city, could only be relied upon to strain and clarify the water, but not to purify it from chemical substances held in solution. In cases like that of river water in large cities, the simple removal of impurities held in suspension, however, often leaves it in a very potable state.

By an Act of Parliament, passed in 1852, the London Water Companies were required, among other things, to filter all the water they

furnished their tenants. They all petitioned against the passage of this Act, but were defeated, and in 1856, had expended eleven millions of dollars to conform to its requirements. It may be supposed, therefore, that these companies were not extravagant in their expenditures, and that with all their advantages for planning and constructing such works, their filter beds may be considered as at least judiciously economical.

The following are the areas of the filter beds, together with the daily average of water supplied by the different London companies, as reported by Messrs. Austin, Rayner and Dickens, Superintending Inspectors of the General Board of Health, July, 1856:

| | COMPANY. | Area in square yards. | Average daily supply in wine gallons. | Kind and Thickness of Filtering Medium. | | |
|---|---|---|---|---|---|---|
| | | | | Sand. | Shells. | Gravel. |
| 1 | Grand Junction, | 25,000 | 8,057,000 | 3 ft 6 in. | 0 | 3 ft 6 in. |
| *2 | Southwark and Vauxhall, | 21,777 | 12,397,000 | 3 ft 6 in. | 0 | 3 ft 6 in. |
| †3 | West Middlesex, | 21,780 | 8.274,000 | 2 ft 9 in. | 0 | 1 ft 6 in. |
| †4 | Lambeth, | 3,555 | 7,330,000 | | 0 | |
| 5 | Chelsea, | 9,680 | 8,296,000 | 3 ft 4 in. | 0 ft 2 in. | 4 ft 6 in. |
| 6 | New River, | 43,560 | 30,000,000 | 2 ft | 0 | 3 ft |
| ‡7 | East London, | 58,080 | 19,200,000 | 3 ft 6 in. | 0 | 0 |
| ‡8 | Kent, | 12,820 | 2,836,000 | 2 ft | 0 ft 6 in. | 2 ft |
| 9 | Hampstead, | 701 | 723,000 | 1 ft 6 in. | 0 | 1 ft 9 in. |
| | | | ‖97,113,000 | | | |

REMARKS.—* Capable of filtering 21,600,000 gallons daily.

† When the river water is turbid, a filter bed is said to run freely only for about three days. Filter beds composed of sand and gravel together, 6 feet thick.

‡ 13 filter beds in all—seven in one circle and six in another. The filtered water appeared brighter than that of any other London Company. Could filter 48,000,000 gallons daily.

‖ In 1827, the supply from the first seven Companies mentioned, was 34,800,000 gallons.

An inspection of the foregoing statement will show a greater diversity of opinion and practice than would have been expected under such circumstances, but much of this diversity is more apparent than real, as some of the companies made far greater preparations for the future than others.

The case of the Lambeth Company, which made one square yard of filter bed surface answer for a daily average of upwards of 2,000 gallons, is the only one that exceeded about 1,000 gallons, and can hardly be considered a safe example to follow, as at certain times their filter beds became foul in about three days. The general expectation appears to have been, that not more than 800 to 900 gallons could be relied upon from one square yard. Mr. Hawksley, whose opinions appear to have had great weight, allowed usually one square yard of filter bed surface for an average daily supply of 840 wine gallons.

The East London Company, whose filter beds are spoken of by the Government Inspectors in the most approving manner, appear to have expected about 828 gallons.

On the supposition that 840 gallons to the square yard would be a proper allowance for Chicago, and that the daily consumption in summer will reach 14,000,000 gallons in 1870, there would be required a filter bed with a surface of 16,666 square yards.

Taking into account the value of land, and the saving of additional pumping works expressly for supplying the filter beds, it would, no doubt, be the most economical plan to construct the filter beds within a circular area, on and near the lake shore at the present pumping works.

In order to prepare the floor, lay the drains, and complete the construction of the filter beds, and be able to make future excavations and removal of sand, it would be necessary to enclose the whole in a water-tight dam. As a part of this would be exposed to the action of storms on the lake, it would have to be very strong, or else protected by a permanent breakwater.

The clay foundation is about 18 feet below the average water level, and must be reached in order to make an impervious dam. To construct this dam, which must, unless protected by a strong breakwater on the lake side, be made in part at least of masonry, a coffer dam to enclose the whole would be required.

The outer circumference of the top of the dam or wall enclosing the filter beds, would be about 1,400 feet.

The probable cost of such a set of filter beds must of course be doubtful. The following estimate is the best my present information enables me to make:

| | |
|---|---|
| Excavation and dredging for coffer dam, - - - | $7,500 |
| Coffer dam, - - - - - - - - - - | 18,000 |
| Pumping, - - - - - - - - - - - | 5,000 |
| Wall or dam around filter beds, - - - - | 22,000 |
| Filter beds, including floor, drains, sand, etc., - - | 55,000 |
| | $107,500 |

The cost of the English filter beds is said by Mr. Hughes, author of a treatise on Water Works, London, 1856, to range probably from $4.50 to $7.50 a square yard. At these rates, the Chicago filter beds would cost from $75,000 to $125,000; the unusual difficulties to be met with on the lake shore would seem to justify the adoption of the larger sum; but, on the other hand, the abundance of fine sand on the spot ought to cause a great saving.

In addition to the first cost of filter beds, the annual expense of keeping them in order is a considerable item, being in England from two to eight-tenths of a cent for every one thousand gallons filtered. The probability is that less than the smallest of the above rates would be sufficient here for most of the year, because the water of the lake is so often, even along the shore, very nearly as clear as a filter could make it.

What the difficulty would be however, in a very cold winter, with ice 15 to 20 inches thick, and temperature below zero, in clearing the filter beds, actual experience could alone determine. They have very little or no such weather, and consequently, no such experience in England. There appear to be no extensive filter beds in this country.

Some cities are so situated as to be able to take advantage of *natural filter beds*, as Toulouse in France, and Hamilton, C. W. These do not require periodical cleansing, as do the artificial ones; on the other hand, it is necessary to give them greater surfaces, in proportion to the amount of water to be filtered.

At Toulouse they excavated trenches in the natural soil, to a depth of about 6½ feet below the level of the Garronne, built collecting drains, and then covered them over, restoring the surface of the ground to its original state. In this way they obtained a supply of about 1,000,000 gallons daily of limpid and cool water for a little over $100,000. But in consequence of the want of experience, their works cost them considerable more than they ought. Admitting that they might be constructed now, at half this rate, it would then cost $700,000 to supply 14,000,000 gallons daily. Aside, however, from the greater cost of this plan over an artificial filter, the danger of being interfered with along the shore by public and private improvements, would be very great, unless very large sums were paid for reparian rights. Moreover, the land water, which would then find its way into the drains, is said to be quite inferior to that of the lake itself.

At Hamilton, as Thos. C. Kiefer, Esq., civil engineer of the water works, thus informs me, they took advantage of an old excavation near the lake shore, on Burlington beach, and obtained an open reservoir of 9,635 square yards surface at mean water, in a remarkably favorable filtering material, and at little cost.

Another mode of delivering the water in a much clearer state dur-

ing storms than is done now, would be to build a *subsiding or settling reservoir*, a method resorted to very frequently in England, some times without, and sometimes in connection with filter beds. Since 1852, however, compulsory filtration has caused some of the subsiding reservoirs to be discontinued as uselessly large, while others are used for storing the filtered water.

All water discolored by sedimentary matter, such as clay or pulverized sand, will become clear of itself, if allowed to stand undisturbed a sufficiently long time. No rule can be given however, for the length of time required, as some waters are longer in becoming clear than others; and the water of the same stream or lake will at one time be longer than at another in settling.

Experiments made by Mr. Cregier, the first of this month, show that our lake water in its turbid state, becomes comparatively clear in a cask in twenty-four hours; it still retains after that, however, a slightly milky hue, which it parts with very slowly, becoming entirely clear at the end of six or seven days.

Mr. Cregier's observations on the condition of the water in the lake show that it is seldom turbid more than three days at any time, very rarely as much as five.

Judging from these circumstances, it would seem that a subsiding reservoir that would hold a supply for five days, ought to be sufficient for two years to come, to give to the city clear water at all times, with perhaps rare exceptions. It is evident, however, that a large amount would filter through the sides of the reservoir, in case the material should be porous, and the surface drawn down below that of the lake; enough in five days probably, to supply the city one; thus rendering it unnecessary to give the reservoir a capacity to hold over 40,000,000 at low water level. The longest storms are in the spring, a season in which the average daily consumption is rather less than more than that of the whole year.

Such a reservoir should be at least 12 feet deep, thoroughly protected from the storms of the lake, and for the sake of both strength and economy, circular in form. It is therefore proposed to give it an average interior diameter of 714 feet, to protect it with strongly built cribs 20 by 20 feet on the exposed lake side, to make the dam 30 feet wide on the top, to make the interior slopes, two horizontal to one perpendicular, and cover them with one foot in thickness of coarse gravel or broken stone, and to provide means for supplying the pumping well directly from the lake, in case the water outside

should be clearer at any time than that inside. Upon these data, the following estimate is based:

| | |
|---|---|
| 1,500 lineal feet of crib work, average 20 by 20 feet, such as is used in the breakwaters, @ $50, | $75,000 |
| 750 lineal feet of strong sheet piling, | 1,500 |
| 89,000 cubic yards dredging, most of which is to be used in the dam, @ 25 cents, | 22,500 |
| 2,200 cubic yards gravel covering of slopes, @$1.50, | 3,300 |
| 1,500 lineal feet of palisade fence, spiked on to outside face of crib work, and projecting 4 feet above it, @ $1.25, | 1,875 |
| Regulating gates at inlet from lake, | 1,000 |
| 900 lineal feet of 3 feet wooden pipe through reservoir, to supply directly from lake, @ $1.50, | 1,350 |
| 2,500 lineal feet of plank walk around reservoir, @ 50c. | 1,250 |
| | $107,775 |

It should be remembered, that water in large cities is liable to be affected by smoke, which gives an unpleasant kreosote taste.

The more the city grows, the greater will this nuisance become. In London they recommend the covering over of their reservoirs with brick arches, when practicable, at an expense of about 25 cents per square foot. This not only excludes soot, but effectually checks the growth of vegetable matter. Such a remedy here would cost about $120,000, and might not be needed for fifty years, if then.

An examination of the foregoing statements will, no doubt, lead to the expectation that some plan for obtaining at least clearer, if not purer water, will be now recommended.

The difficulty is this:

The pipe, and the tunnel plans, are not only uncertain as to their cost; but of doubtful benefit if completed, so far as clear water and the injurious influences of the river are concerned, though of probable advantage, in avoiding the wash of the shore.

The filter beds would undoubtedly be the most certain in their action, giving the clearest water, except perhaps in the coldest weather; but, besides their first cost, they would entail an increased, and probably, important annual expenditure.

The subsiding reservoir would give water sufficiently clear for all ordinary domestic purposes, leaving it necessary to filter by private arrangements, only for those who feel they must have limpid water at

all times; but the possibility of the water in such a reservoir, being at times injuriously affected by smoke, even in the distant future, is an unpleasant feature. The probable sale of ice from the subsiding reservoir, ought to equal the interest on more than half its estimated cost.

My opinion *in view of the whole subject* is, that further time should be taken to consider it; and that before expenditures are made on either of the above, or any equivalent plans, there should be several analyses of the water as it is received at the pumping station, at different distances from the shore, and that which may be had by able chemists. This would show if the opinion that the water of the lake is not only purer but softer one mile out than it is along the shore, is well founded or not.

If there should be such a difference in the water taken from the points, as would affect the general health or comfort of the inhabitants, then it would, no doubt, be advisable to expend not only $100,000, but more than double that amount, to procure a purer supply than the present; but if there is no appreciable difference, why should Chicago do what no other city in this country, under similar circumstances, has done. The London Companies were obliged by law to make enormous expenditures on this account; but that compulsion was based upon theoretical views, as to the effect of certain vegetable and animal substances contained in the Thames, and other water supplied by those Companies. The quantity of animal and vegetable substances, in the unfiltered water of the London Companies, is very much greater than those of Lake Michigan.

As an instance of the wholesomeness of unfiltered river water, Philadelphia is the most healthy of all the large cities in the world, so far as we have statistics to show, and yet the most of its supply comes from the Schuylkill, which is often very turbid, seldom if ever entirely free from discoloration, and the receptacle of several large towns and of a populous region along its course.

While the water furnished to Chicago, owing to the presence of lime, undoubtedly contains more solid matter than that furnished to either Philadelphia or Boston, it probably contains less organic matter, and yet the idea of filtering the whole of the water supplied to either of those cities, seems never to have been seriously entertained, certainly never carried out.

The following tabular statement of analyses of the water supplied to, or proposed for different cities, may be of interest in this connection:

| Source. | City Supplied. | Grains of solid matter in a wine gallon. | By whom analyzed. | By whom and when reported. |
|---|---|---|---|---|
| Lake Cochituate, surface, | Boston, ..... | 1.85 | Silliman. | Jervis & Johnson. |
| " " 62 ft. below [surface. | " ..... | 3.37 | " | " " |
| Croton Lake, ..... | New York,..... | 4.16 | Chilton. | W. J. McAlpine, 1852 |
| Long Island Streams, .... | Brooklyn, ..... | 1.97 | " | " " |
| Patroon's Creek, ..... | Albany, ..... | 4.72 | ..... | H. P. M. Birkinbine. |
| Passaic River, ..... | Jersey City,..... | 7.44 | ..... | " |
| Schuylkill River,..... | Philadelphia,.... | 4.42 | Boye.... | " 1860 |
| Jones' Falls,..... | Baltimore,..... | 5.85 | ..... | " " |
| Potomac River, | Washington,.... | 5.59 | ..... | Jacob Houghton, 1859 |
| Genesee River,..... | Rochester,..... | 11.21 | ..... | H. P. M. B., 1860 |
| Lake Ontario,..... | " ..... | 4.16 | ..... | Jacob Houghton, 1859 |
| Burlington Bay,..... | Hamilton, C. W.. | 7.03 | ..... | ..... |
| Detroit River. | Detroit, ..... | 5.72 | ..... | ..... |
| Ohio River,..... | Cincinnati, ..... | 6.74 | Locke... | 1853 |
| St. Charles River, ..... | Quebec, (average) | 6.75 | Silliman. | Geo. R. Baldwin, 1848 |
| Thames River,..... | London,..... | 17.97 | Taylor .. | ..... |
| Seine River,..... | Paris,..... | 10.60 | ..... | ..... |
| | Edinburgh, ..... | 10.74 | ..... | ..... |
| Lake Geneva,..... | (Switzerland,)... | 10.64 | ..... | ..... |
| Elbe,..... | Dresden, ..... | 21.00 | ..... | ..... |
| WELLS. | | | | |
| Manhattan,..... | New York,..... | 104.00 | ..... | ..... |
| Average of several others, | " ..... | 49.00 | ..... | ..... |
| Lydius Street, ..... | Albany, ..... | 19.24 | ..... | ..... |
| Capital Park,..... | " ..... | 65.20 | ..... | ..... |
| Average of five in..... | New Haven, .... | 20.32 | ..... | ..... |
| Average of several in.... | Brooklyn, ..... | 48.83 | ..... | ..... |
| Longacre,..... | Boston, ..... | 56.80 | ..... | ..... |
| Tremont Street,..... | " ..... | 26.60 | ..... | ..... |
| Average of several in.... | Rochester,..... | 30.00 | ..... | ..... |
| Average of nine in ..... | Washington,.... | 16.00 | ..... | ..... |
| Park Lots,..... | Detroit, ..... | 116.46 | ..... | ..... |

Much difficulty was met with in compiling the foregoing table, owing to conflicting results of different analyses, and to the want of a uniform gallon measure in different States and countries.

It is evident that samples from the same body of water will vary in quality according to the time, locality, depth and other circumstances under which they may be taken. For this reason the suggestion has already been made, to have samples of Lake Michigan water from points at different distances from the shore, and taken at different times, analyzed.

Should such an analysis show any appreciable effect of the wash of the shore on the water, there is not any probability it will be detected more than two, or at the outside, three hundred yards from the shore. The distance would just reach the line of safe navigation for lake

vessels. It would be comparatively easy to lay a piece of pipe that distance to a permanent pier of crib work to protect its inlet, and to construct a pile bridge leading to it, the piles in which bridge could be used to insure the safe laying of the pipe. If the present basin were then dredged out to a depth of 10 or 12 feet, and the crib work around it made tight against the influx of waves, but not against filtration, the supply of water to the city, though it might not always be clear, would at least be free from the fine sand that now cuts the valves of the pumps, and threatens in some cases to obstruct the flow through the pipes. The whole of this work could probably be done, or a tunnel made that far out, like the one already described, for less than $30,000.

In the lower part of the foregoing table will be seen the analysis of well waters in different cities. Its great inferiority in regard to purity, as compared with rain or lake water, is very marked, and yet, owing to its being so often clear, cool and sparkling, it is frequently preferred by those accustomed to using it, to much purer kinds.

With regard to the matter of "*erecting additional pumping works in such locality as shall appear most advantageous for obtaining a permanent supply of pure water*," the inquiry naturally arises, is there any necessity for additional works?

The present means of supplying the city consists of two steam engines, each with two pumps. The estimated capacity of the large engine and pumps, when making ten revolutions a minute, the supposed limit of safety, is 11,750,400 gallons in 24 hours; and that of the small engine and pumps, same speed, 7,470,720 gallons in 24 hours. These engines and pumps are in excellent order, and will, no doubt, be kept so. They have proved abundantly sufficient for the past and present wants of the city; but if the rate of consumption continues to increase as it has done, the probability is that the large draughts to be expected next summer, will be fully equal to, and may possibly exceed the capacity of the small engine and pumps.

As the large engine, like the small one, is liable to get out of order when most needed, it is evident that the time is rapidly approaching, when a short supply may be unavoidable. This of itself, if it merely prevented useless waste, would be no great calamity, but as there is no hope of preventing waste, and as extensive fires may occur, the thought of purposely furnishing a short supply cannot be innocently entertained.

If it were not for the three reservoirs which have a united capaity of 1,500,000 gallons, it would be impossible to supply the city with over 7,000,000 gallons a day satisfactorily, because the draught is much larger during the day than at night.

If then, additional pumping works are needed, where should they be erected? So far as economy in the first cost of construction and in future maintenance is concerned, it is evident that nothing is to be gained by going away from the present works.

The rapid growth of the southern portion of the city, and the constant movement of the centre of population in that direction, have suggested the propriety of erecting duplicate works on the lake shore, somewhere south of Twelfth Street. The probability is, that the time is coming when a proper appreciation of the cost of distributing the water and maintaining an efficient head in that part of the city, will show the necessity of erecting such works, if no objection should exist as to the purity of the water there. But if the *thought* that the river, *against* the usual course of wind and current, may occasionally corrupt the present supply, operates so powerfully on the imagination of some, what would be the effect, if the supply was taken from a point within reach of the ordinary influences of the river? Besides, in the extension of improvements in that part of the city, outlets for large sewers must be made into the lake, while north of the river, there is not, and need not be, the outlet of a single sewer. Again, should the time ever come, when, in order to free the river from its present impurities, it will be necessary to construct similar works to those they are now building in London, to keep their sewage out of the Thames, the outlet must be in the southern part of the city, unless it should be found practicable in the meantime to utilize the sewage for agricultural purposes. The proposed deepening of the Illinois and Michigan Canal, if carried out, would probably render such works needless for a long time, if not forever, as well as remove all ground of complaint against the site of the present pumping works. It is impossible, however, to foretell what theoretical views may influence future legislation on this subject.

To go further north with the works would increase the cost of distribution, and annual maintenance, but would evidently remove the point of supply further from the possible influences of the river. How much it would be worth to reduce such a possibility, depends upon circumstances, which are matters of feeling, and do not come within the province of engineering calculation.

It is very evident that our supply must come from Lake Michigan, and it is doubtful if a purer body of water exists in the Northwest. Is it, however, as now supplied to the city, so affected by the river or the wash of the shore, as to be appreciably injured? Imagination has been very busy on this point, and it would be vain to oppose individual opinions against it. The only satisfactory way of settling the matter would be by having careful analyses, as already suggested, made.

In view of all the circumstances, it seems to me advisable to make such an addition to the present engine house as would accommodate another engine and pumps capable of supplying 14,000,000 or 15,000,000 gallons daily, and to make arrangements for the erection of such engine and pumps during the coming season; and to leave the matter of erecting duplicate Works, either south or north of the present ones, until there shall be an undoubted necessity for them, when, perhaps, the more important questions which now complicate this subject will have been settled.

As the purity of water is a subject which deeply interests all the citizens of Chicago, several extracts relative to it, and to modes of preserving and improving it, from English parliamentary documents, will be found accompanying this report.

The large, white-looking animalcules, which were so abundant in the lake water a short time since, a species of cyclops, are found in the Cochituat water supplied to Boston, which the table already given shows to be as pure as that of any large city in the country. They are also found in the water supplied to London by the New River Company, which furnishes more than any other to that city.

The smoky or kreosote taste, which was so disagreeable for about three days, the early part of this month, occurred once before, for a shorter time, this winter. It has also been noticed several winters previous to this. The circumstances under which it has always occurred appear to be uniform. They are, rain and thaw, on a surface for some time previously covered with ice and snow. The snow and ice become highly impregnated with smoke, and when thawed, are, to a considerable extent, washed into the lake in the vicinity of the pumping works.

Respectfully submitted.

E. S. CHESBROUGH,

*Ch. Eng. Sew. Com'rs.*

# EXTRACTS

EROM THE "MINUTES OF EVIDENCE TAKEN BEFORE THE SELECT COMMITTEE ON THE METROPOLIS WATER BILL." LONDON, 1851 AND 1852.

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*From examination of A. S. Taylor, M. D., F. R. S., July* 30, 1851:

12,150.—It would be naturally supposed that the deposit caused by sewage would produce more effect in the form of organic matter than that which proceeds from vegetable substances generally? In what way do you mean?

12,151.—So as to produce a greater result when you come to an analysis? That is not the case as far as concerns the water here analyzed; all such substances are very rapidly decomposed and destroyed; the nitrogen is converted into nitric acid; the sulphur is converted into sulphuric acid; so that those fœtid and putrid substances which go into the Thames from London, when rolled about by the action of the water containing an enormous amount of air, are all oxidized and destroyed; within a certain limit they may be found; but still, after a very short passage, they are very soon indeed destroyed.

12,152.—You are not singular in the view you now express, I believe? I believe it is the opinion of every chemist who has considered the subject, that sewage matter does not remain as sewage matter in well aerated water, but that all phosphorous, sulphur and nitrogen are speedily destroyed by the oxygen in that water. Every 1,000 gallons of water will contain 46 gallons of oxygen, and that oxygen destroys all such putrescent effluvia.

12,153.—Nature seems to have provided, therefore, for the mixture of sewage matter with water? It does; with water not exposed to the air, and not containing air, it is most offensive and unwholesome; but with water containing air, like the Thames, and exposing an enormous surface to the air in its daily motion, the effect is completely to obliterate every trace that a chemist can detect.

12,154.—I find an illustration upon the notes here, drawn from the growth of cucumbers upon dung heaps? When manure is put upon a cucumber bed, it is not the offensive or putrefying matter which goes into the cucumber or melon, but there is a chemistry going on, by which the elements of animal matter are converted into new substances, and go into the vegetable in a different state; there is a process of oxidation and incorporation.

12,155.—And a similar process takes place upon the mixture of this sewage matter with the water? To a much greater extent. In the Thames, and other water, the air is in a state of solution, the matter in a state of diffusion, and thus the air and this fœtid matter are in the very condition to combine together and form an innoxious compound; it requires time and motion, but still it does take place with very extraordinary rapidity.

12,156.—That result you found practically in the analysis which you made of the water above the Tower? Not only in my own case, but also in the Government analysis, and every analysis which has been made by every chemist.

12,157.—Will you explain how it is that the water taken from the Tower contains eight grains of organic matter, and in the other cases a smaller quantity? It is a question of rapidity. Undoubtedly there is about London, particularly near the bridges, a very great and abundant flow of this sewage matter into the river; but after a certain passage up and down, this change will take place. I do not believe that the eight grains at the Tower would represent the whole quantity. Some has been destroyed. Mr. Aikin and myself, who made the analysis, were rather surprised to find so little. If the water were taken at a certain time near a sewer, we might find 20 or 30 grains in a gallon; but the process is going on, and by the time the water has passed six or eight miles, according to the wind and other circumstances, you may have a complete decomposition of it.

12,158.—But still, the water taken at the Tower you would think very objectionable for use? Yes, I do not recommend the Tower water; I am merely accounting for a fact, which I believe has been popularly quite misunderstood. The supposition that the drainage of London, which goes into the river about the bridges, remains the drainage of London all up the river, is contrary to all chemical experience; it is contrary to every chemical fact, and every chemical analysis.

12,159.—You said that, to a great amount, motion tended to produce this decomposition of the sewage matter? It does. I may mention an experiment to the committee, which I made upon that very point last year. Professor Cooper, who, I believe is in the room, and myself were determined to test practically this destruction of organic matter, or the fœtid effluvia of drains and sewers. We put into the water, supplied by the Vauxhall and Southwark Company to Guy's Hospital, some of the foul liquid which drains from the privies, called the hydrosulphuret

of ammonia, the most fœtid liquid that chemists are acquainted with. We put about half a teaspoonful into a bottle of water, containing probably about 50 ounces of water. We gave it a shake up, and covered it over, so as not to allow any loss by volatilization, and allowed it to settle 24 hours; in ten minutes the sulphur of that fœtid liquor began to precipitate, and in 24 hours there was none to be perceived, and Professor Cooper drank a quantity of the water. I mention that as a fact, to show that oxidization does go on with rapidity.

12,160.—Does the flow and reflow of the tide produce that kind of motion, which you think would accelerate the action? No doubt of it. I think, if the Thames were a stagnant sheet of water, we should not have the destruction of organic matter which we now practically find, but we should have, extending for 10 or 15 miles up, a much larger proportion to the imperial gallon that we now find.

12,161.—Have the goodness to refer the committee to those passages in the Government report which support the view which you have given? I would beg to refer the committee to the Appendix No. 3 of the Board of Health Report on Water Supply, page 164. The question is put to Dr. Clarke, a very distinguished chemist: "Is the animal matter which passes into the river by the sewers seperable by filtration, or any other means?" His answer is this: "The solid portion of it may be seperated by filtration, but not the portion of it held in solution. At the same time, I must say, that I think very undue weight has been given to the presence of organic matter, and especially of animal matter, as if, because it was inseperable by filtration, it still must retain the same offensive character as when it entered the water. I think this will appear exceedingly unlikely, when you observe what occurs in the well known process of making nitre artificially, when such animal matter as the washings of the cow-house is converted so readily into the basis of nitric acid." They make nitre in Switzerland by allowing the drainings of the cow-houses to flow over chalk and potash. The nitrogen which gives the offensive quality to animal matter becomes oxydized and forms nitric acid, and produces nitre on a very large scale. Dr. Clarke continues: "When you consider how readily such matters are likewise changed in the usual process of vegetation, and when you consider further how readily dead animal matter changes spontaneously, for such reasons, I think that it is assuming far too much to say that such animal matter as passes into the river remains there unchanged, especially remembering how freely a river is exposed to the action of air,

and recollecting the other matters that are present, so calculated in such circumstances to increase chemical action, as for instance, the alkaline substances present. Under such circumstances, I think it is very unlikely indeed that the elements of animal matter do not undergo change, and rapidly too, into some other state of combination." In that opinion I perfectly concur, and I believe it is the opinion of every person who has devoted his attention to chemistry for many years together.

12,162.—Does the same kind of process take place to the same extent with regard to vegetable matter? It does; vegetable matter and animal matter contain in many points of view, the same elements, and have the same tendency to change.

*From the same, July 30th,* 1851.

12,209.—I believe it is the opinion of chemists, and particularly of Professor Liebig, that the presence of these animalculæ is not injurious to health? I do not believe they are any more injurious than fish in water. I cannot comprehend on what ground it has been asserted; there is not a single medical fact that would justify it.

12,210.—I believe there is a passage on the subject in Liebig on Chemistry? This is from "Letters on Chemistry by Baron Liebig," whom I think one of the most eminent chemists we have in modern times.

12,211.—And I believe he has particularly studied chemistry, with a view to dietetics? He has studied chemistry in regard to its organic department. He says: "Without venturing to draw any inference from these data, with respect to the mode of nutrition of these creatures," —by that he means microscopic animals.—"it is certain that the water in which infusoria exist, under the influence of the solar light, contains a source of pure vital air." He had found, by filtering the water, and separating the vegetable matter, and then exposing the water to the light, a quantity of oxygen was given off, which he ascribed to the fact that the animals had liberated the oxygen under the influence of the light. "It is certain," he says, "that from the moment these animals are perceived in the water, this water ceases to act injuriously upon the higher orders of plants and animals; for it is impossible to conceive that water should evolve pure oxygen, while it contains putrefying or decaying substances, that is, matters which are capable of combining with oxygen." He then concludes, as a scientific chemist, that where you have oxygen evolved from the water, or oxygen free in water, you have a condition incompatible with the existence of putrefying or decaying animal matter. He

says: "Now if we suppose some animal matter, in a state of putrefaction or decay, added to water of this kind, this matter must of course be resolved into its ultimate products, in the presence of such a source of oxygen, in an infinitely shorter space of time than would be the case were these infusoria not present." So that most conclusively, upon the theory of this excellent chemist, the quantity of infusoria which may exist in the sediment of the water of the Thames may be really instrumental in setting free the oxygen from the organic matter, in addition to what exists from the air in the water, and thus aiding in the destruction and rendering innoxious the foul matters which are sent into the river. He says: "In the most extensively diffused animalculæ, namely, the green and red infusoria, we recognize a most admirable cause, which removes from water all substances injurious to the life of the higher classes of animals, and creates in their place nutritive matters for the sustenance of plants, and the oxygen indespensable to the respiration of animals. The infusorial animalculæ cannot be the causes of putrefaction of the production of poisonous matter deletorious to plants and animals; but an infinitely wise intention designs them to accelerate the transition of the elements of putrefying substances into their ultimate products." I think that opinion is really not only scientifically accurate, but a perfectly true exposition of the modern chemical theory.

*From the same, April* 6, 1852.

537.—You have said that you think all water should undergo filtration? All river water.

538.—You recommended, in your evidence last year, that all reservoirs should be covered? Yes, within a certain distance of inhabited places; I think that very important.

539.—On what account do you think it very important? In order to keep out the light, which is desirable for this reason: if there be any organic matter in the water, as there is in almost all water which has touched the earth, the influence of light causes vegetation to take place; the water becomes covered with a green scum; it looks offensive; the vegetable matter decomposes; the water acquires a taste, and is injured. At Guy's Hospital, we have two cisterns, one covered and the other uncovered; my opinion is based upon the results observed there; each cistern contains 75,000 gallons of water, the two together holding 150,000; one cistern covers the other; in the upper cistern, exposed to all the foul effluvia of the borough, smoke and other matters, we see constantly

a kind of green scum forming, the water being at rest; that is another very material point; water in motion does not vegetate so readily as water at rest. The cistern underneath is quite clear and free from any vegetable matter, so that it is the light produces the action organic and promotes the growth of vegetation. To have the reservoirs covered effectually, prevents the absorption of any foul gases which may predominate in the atmosphere.

540.—You spoke of deposit, as well as filtration; do you recommend that the water, when taken, should be carried first into basins, for the purpose of deposit, and afterwards into places for the purposes of filtration? I do.

541.—You would have the double security, first, of depositing reservoirs, and secondly, of filtering reservoirs? It is very important that it should be so; if the water were liable to become turbid from floods, or any other accidental causes, as all river water is, the effect of not having a deposit reservoir would be, to block up the pores of the filter and spoil it in a short time.

542.—With a view to having the filters in good order, it is desirable that the water should not be brought into them in a turbid state? Yes, that we should allow as much of the floating impurity to subside as possible; it is quite possible to obtain water perfectly filtered by pouring it on the filter in a turbid state; but it is a bad thing to do so, because the insoluble matter is of course locked up in the sand; and, therefore, it tends to spoil the filter and contaminates the water which comes afterwards.

543.—In proportion, as any part of the Thames is disturbed by steamers, so far that part of the Thames is an inconvenient situation for the purpose of taking the water from which is to be filtered? Unless depositing reservoirs be first used; but I must say, certainly, as a scientific man, judging of this matter, that that agitation of the Thames water is a most important preservative of its purity, and prevents that putrefaction which would take place by its being stagnant; it aerates the water. As to the diffusion of sand and mud, that amounts to nothing; that is a mere mechanical effect, which is easily removed by subsidence and filtration; the water is none the worse for that; I should prefer water which is in constant agitation, either by the motion of the tide or the current of a river, or the motion of vessels upon a river, so as to bring enormous surfaces of water into contact with the air; I am now speaking in a scientific view of the matter; and I think there has been a great mistake in supposing that those steamers or other vessels on the

river affect or injure the quality of Thames water: I believe they do not; the fact shews that they do not.

544.—According to that view of a disturbance of the water being better for it, it would seem that they improve it? They aerate it more, but at the same time, from the muddy nature of the banks, they undoubtedly cause a great deal of turbidness to take place, and if that turbidness could not be got rid of in an easy manner, I should say it was not a proper site to take the water from; but if it can be, and the water is easily obtained, I should select that as a site to take the water from.

545.—You referred to the evidence of the three chemists appointed by the Government; you said that you generally agreed with them? Yes.

546.—Will you look at page 8 of their Report, and state whether you agree with them in this: they there say, "We agree with engineers who have had the fullest means of observation in considering, that so much this discoloration is due to the compound of clay and organic matter, washed out by the Brent from the extensive and highly manured field of the London clay formation, which it drains, as to make it an object to draw the London supply from a point above the embouchure of that tributary of the Thames at Brentford?" I do not agree with them in that; their analysis proves that they are wrong; I would again beg to refer the committee to this, that they found at Thames Ditton, although there are certainly manured fields round the Brent of matters of that kind, that there was a ponderable quantity of nitrate of lime, which is decomposed sewage. They found it in the Thames Ditton water, and they found only a trace in the West Middlesex water, therefore their facts are contrary to their conclusions.

547.—Finding a trace of nitrogen is not necessarily a proof of animal matter, is it? Not unless it is associated with sulphur.

548.—Nitrogen is common to all animal and vegetable matter? Yes, it is the great basis of hay and straw; so that a bundle of weeds getting into a reservoir always imparts nitrogen to the water.

549.—Therefore there may be nitrogen without implying the presence of any sewage matter at all? Yes, but when we are comparing water containing nitrogen, we should pronounce it to be in a worse condition with regard to organic matter; when the conversion has taken place, it always indicates that there must be a tolerably large quantity of some ammoniacal product, in order to have formed it. Their inference, I think, with respect to the Brent, is entirely contradicted by the facts of their analysis.

550.—With respect to animalcules in water, you stated in your evidence last year, that animalcules were not injurious? Certainly not.

551.—In point of fact, as I understand your evidence, you think animalcules improve the water rather than otherwise? That is the prevailing chemical opinion now, that animalcules are a wise provision of nature to remove a quantity of organic matter contained in the water, so that even the animalculæ which you may perhaps have seen in the Hampton water, does not at all prejudice me against it; there is organic matter there, and these little animals are constantly consuming that organic matter, which might otherwise be injurious to health; they are setting free oxygen, and tending to aerate the water; therefore, though I would not say that the water was in all cases better, I do not consider it worse for their presence; and if the water be filtered, any visible animalcules of course are easily arrested by the filtration, while the very minute ones which go through are so infinitesimally minute that they would not form more than the 8,000,000th of an inch, and swallowing half a dozen of those would not affect us at all. At the artesian well at Trafalgar square, within the view of every one, after the water has come up into the fountains, a general vegetation takes place, and there are abundance of infusoria. I observe that the microscope has not been turned to the Kingston water at all; if it had, animals would have been seen in the residue of that water, as well as in all the others, but that is not to be looked upon as an objection to the Kingston water. It is most unfair to apply the microscope to drops of water taken here and there in selected parts of the river, while at the same time every scientific man knows, that from Gravesend to the highest point of the Thames, if you examine the sediment, you will find animals in it.

552.—*Mr. Burke.* Will you look at questions 12,210 and 12,211, and say whether you concur in the opinions thre given? Liebig is a very excellent judge upon these matters, and he considers that those animals are rather beneficial to the water; and when I know that in Windermere, and in every river in the country, and every lake in the country, you find them, and that it is impossible to keep them out, except by hermetically sealing up the water in a glass tube, or putting it in vacuo, it is really absurd to make the quality of the water depend upon their presence. There is no water supplied to London, or to any large population, as to which a man could always be upon the watch to keep out those minute beings. One drop will contain tens of thousands; they abound as organic matter abounds in water. I find in the Caversham

water four grains in the gallon of organic matter, supplying ample food for tens of thousands more animalcules than we meet with here; besides, I would say, referring again to what has been stated of the sewage water of the Thames, that those animals are instantly killed by sewage water; therefore, two opposite statements have been made, one that the water of the Thames abounds in animalcules, and another, that it abounds in sewage matter, which is their poison, just as prussic acid is poison to man.

553.—*By the Committee.* I understand you to have stated, that in your opinion, the cholera was in no way affected by the quality of the water? I do not think it is ever produced by the quality of the water; I do not think that there is any fact to show that the Thames water in any way increased or occasioned the attacks of the cholera; I think you will find in my evidence, that I stated I had made particular observations as to the number of patients admitted into Guy's Hospital in the cholera year, amounting to 3,200 persons, and that there were only four cases of cholera which were brought in from the neighbourhood.

554.—You state in answer to question 12,230, "We cannot in any part of the world connect the ravages of the cholera with the quality of the water?" That is my general statement: I have paid attention to that subject; I have lived in Rome and in Naples, and other places, where all kinds of water are used, and I could never connect the ravages of the cholera with the quality of the water; in Rome the cholera was more severe than in any city in Europe, and yet they have the best water that can be supplied through the Roman aqueducts; therefore, I say again, there is not the slightest ground for asserting that the quality of the water influences the cholera; it was more fatal in Rome than in London, and the water of Rome is far better in some of its properties than we have here.

*From Examination of J. T. Cooper, Esq., April 20th,* 1852.

690.—Do you think that the water for the supply of the metropolis should be filtered before it is used? It is a very good precaution to do that; but I do not think that any filtration would make the water before the committee brighter than it is at present. There may be certain states in which the river may be when the water will hardly ever be cleared by filtration; there is a certain milky state of the river occasionally, which will not be removed by filtration, but it will become clear by subsidence, in the same way as a brewer finds his beer become clear; he puts a coarser matter into it to entangle the fine, and it all goes down together. The more turbid the water is, the quicker, in my experience, will it clear itself.

691.—Should you recommend the West Middlesex Company to filter their water, or not? I should.

692.—You said that you agreed with Professor Taylor's evidence generally? Professor Taylor said that all the reservoirs that were in the midst of a populous district should be covered. Do you agree with him that reservoirs in the midst of a populous district, or containing water to be drunk by the inhabitants, should be covered? I think it would be a very good thing if they were, because it would prevent the growth of weeds, or rather confervæ, and it would prevent the deposition of soot upon the surface, and other matters which might give the water an unpleasant taste. If soot gets into the water, it gives a very unpleasant taste, which cannot be easily got rid of afterwards. I think the covering of reservoirs would be a very good thing.

*From examination of Prof. A. Aitkin, F. L. S., April 20th, 1852.*

781.—What was the proportion which the sewage matter in the water at the Tower bore to the salts of the sea in that water? I found in a gallon of water, taken up opposite the Tower, $44\frac{7}{10}$ of soluble chlorides, the greater part of which was common salt, and eight grains in the gallon of organic matter; a gallon being 70,000 grains, of those 70,000 grains, $44\frac{7}{10}$ were soluble chlorides, and eight were organic matter.

782.—Are those soluble chlorides easily dissolved in water? Yes, they consist chiefly of common salt; common salt is most soluble.

783.—If the tide went up as far as Barnes, would those salts be likely to be found in the water opposite Barnes? Yes.

784.—Without decomposition? Without decomposition; common salt is a very undecomposible substance in common water.

785.—In regard to sewage matter, is that more easily decomposed than those chlorides to which you have referred? The matter which is poured into the river from the sewers is constantly undergoing decomposition by being mixed with river water.

*From examination of J. Walker, Esq., April 21st, 1852.*

1,045.—Would not the water be more perfectly filtered if the reservoir were covered, and thereby the water prevented from contracting impurities from the atmosphere? There would be less impurity in it, but I think it would be a very severe burden upon the water companies to oblige them to do that, because filtration is supposed to rid the water of its impurities.

1,046.—Is it your opinion that the filtration may continue efficient for a considerable period, so far as ridding the water of noxious qualities of a chemical kind is concerned, but that the filter beds may not continue so long efficient without being renewed with respect to those impurities which are of a mechanical nature? I do not understand that filtration could be efficient in removing those impurities, which the honorable Member has referred to, as being chemically combined with water; filtration is useful chiefly in ridding the water of those impurities which are mechanically combined with it; in those cases, the water companies are in the habit of having filters which are at work and filters which are not at work, and they take an opportunity of cleaning the one while the other is occupied in filtration. I am supplied by the Chelsea Company in the house in which I live, in Great George street; their water, as taken from the Thames, is very impure, and occasionally, I may say, filthy; it comes to me, however, in a completely pure state from the very perfect filtration which Mr. Simpson has applied to the Chelsea water.

1,047.—I understand you to be of opinion that the filter beds would require more frequently to be cleaned if the water were not covered? They would.

1,048.—Did I correctly understand you to say that the Chelsea Company filter the water so perfectly that the water comes to you in a good state? Yes.

1,049.—I understood you to say, previously, that you refiltered the water yourself for the table? I do; I call it a very good state, although it is not so perfect as I should like to drink at table; for all culinary purposes it is used as it comes from the water company, and I have occasionally looked at it, and found that it was not in such a state as to require that filtering process.

1,050.—Are you prepared to give an answer at present as to the probable cost of covering the Stoke Newington reservoir? I should be very glad to sit down with Mr. Mylne and devise a filter, and estimate it; I am quite sure that we should agree; if the New River Company propose to filter the water, it is quite a matter of indifference whether they filter it at Stoke Newington or anywhere else.

1,051.—Is it your opinion that the water to be supplied for domestic purposes to the metropolis should be filtered? It is my opinion.

1,052.—From whatever source it may be taken? From whatever source it may be taken in the neighborhood of London.

1,053.—What area round London would you take? I mean for the supply of London.

1,054.—I understand you to say, that after the water has been filtered, you are of opinion it should not be placed in open reservoirs, so as to be exposed again to collect the filth from which it has been previously purified. That is my opinion.

*From examination of Thomas Hawksley, Esq., April 21st, 1852.*

1,173.—You have had considerable experience of water works? I have.

1,174.—Has your attention been directed to the subject of covered and uncovered reservoirs? Very much so, and for many years.

1,175.—With respect to the opinions which have been given as to the importance of covered reservoirs, as contra-distinguished from open reservoirs, what are your sentiments upon that point? There is no question that covered reservoirs are preferable in the abstract to open reservoirs; there can be no doubt whatever upon that question; but so great is the expense which it is necessary to incur in covering reservoirs, at least under many circumstances, that it becomes practically impossible, at least, without a very large increase in the rates which the Company must charge for the supply of water.

1,176.—Theoretically, you would agree with the preference for covered reservoirs? Entirely so, and I practice it wherever I have the means of doing so.

1,177.—In your opinion, is it a question of expense; having regard to the peculiar circumstances in each case? It is entirely so.

1,178.—With respect to what has been suggested as to the sources of impurity, is smoke one in certain places? In some places smoke certainly is a source of impurity, but in other cases it is not so.

1,179.—Is that one of the local circumstances which in your opinion ought to be taken into account in considering the question of covered reservoirs? Yes, if the reservoir be situated in the midst of a very dense population, where trades requiring the consumption of much coal are established, it becomes desirable to cover the reservoir; but even then it cannot always be effected, inasmuch as if the reservoir be a storage reservoir in the ordinary acceptation of the term, its size may be so great as to involve an expenditure which no water company could meet.

1,180.—Did you hear Mr. Rendel give his opinion that this was a local question, to be judged of by each particular company? I did.

1,181.—Do you agree in that opinion? I do.

1,182.—Are your reasons founded upon the opinion you have just given as to the interference with the water by smoke from houses in the neighbourhood? I so understood Mr. Rendel.

1,183.—Are those among your reasons? They are among my reasons, and I have another, that by excluding the influence of light and heat, you diminish the vegetation which is liable to grow; in fact you arrest it.

1,184.—Is another part of the question the impurity which arises from vegetation, if water be subjected for any length of time to light and heat? That is so, and it very much depends upon the length of time during which the water is so subjected to light and heat; but there are very convenient modes now well known, which I have practised myself, for removing entirely the vegetation which is so generated, without going to the expense of covering the reservoirs.

1,185.—Will you explain what those methods are? At Darlington and at Whitehaven, I have placed on the bottom of each service reservoir (for in both those cases it would have been quite inordinately expensive to cover the reservoirs) a coarse strainer of gravel, about the size of small shot; that gravel allows the water to flow through it with great rapidity into the mains, but completely entangles and obstructs all those fine fibres which are the result of vegetation, and also takes out all leaves, and things of that kind, which may happen to flow into the reservoir.

1,186.—I understand you to say, as regards the question of impurity from smoke, that that is entirely a local question? It is entirely a local question, and at the same time a question which is very much misunderstood; it is not the smoke which is apparent on the surface of the water which is the great evil, but it is that portion of it which is dissolved in the water itself which is apt to communicate to it a bitter taste; now, the theory of this Bill, if I understand it aright, is, that filtration will remove that bitter taste; filtration will have no influence upon it whatever, therefore the philosophy of the Bill is so far wrong.

1,187.—Reverting to this smoke question, that source of impurity occasions a bitter taste to the water? As regards so much of the smoke as is dissolved in the water.

1,188.—That, you say, in the first instance, is purely a local question? Yes.

1,189.—The effect in reference to the water is, that a disagreeable taste is imparted to it? Yes.

1,190.—Which will not be removed by filtration? It will not.

1,191.—Then, having regard only to the question of impurity arising from smoke, which is a local circumstance, the provision of this Bill will not meet that as regards the substitution of filtration for covering? It will not; in fact, as I said before, both the philosophy and the engineering of the Bill are in that respect wrong.

* * * * * *

1,195.—What is the difference between a strainer and a filter? The difference is this: that straining may be effected in a small compass and at a light expense; filtration opposes so great an obstacle to the passage of water, its very object being to oppose an obstacle, that a very large surface must be provided, and of course the provision can only be made at a vast charge; we find this practically, that you cannot filter water well, if you pass more than about 700 gallons in 24 hours through one yard of surface; now every yard of surface of a filter bed in London costs 30s., and consequently if you take filter beds for 10,000,000 gallons a day, the cost becomes enormous; you will find that it is more than £20,000, and then it is not effectual, unless you have afterwards a small reservoir to equalize the fluctuations of the draught, and that small reservoir, small as it is in proportion to the whole storage of the company, may cost £8,000 or £10,000 more; £20,000 must be expended by the Lambeth Company, if they are to follow the prescription of the Bill as it stands, although they filter at Thames Ditton.

1,196.—*Mr. Webster.* You draw a distinction between straining and filtration? Certainly.

1,197.—Is the basis of the distinction the amount of the interstices in the material through which the water passes? It is so.

1,198.—Is the filtering medium, using the term as contra-distinguished from straining, sand? The filtering medium is sand, the straining medium may be small gravel.

*From examination of Thomas Clark, M. D., June 16th, 1852.*

10,990.—You are Professor of Chemistry in the University of Aberdeen? I am.

10,991.—You have paid, through many years, a careful attention to the examination of the constituents and qualities of water? Much attention.

10,992.—Have you invented certain tests and processes in respect to the qualities of water? For examining the qualities of water.

10,993.—In respect to the qualities of water, on what two points do they depend; do they depend on the matters they contain, and on the temperature? On the matters which the waters contain and on the temperature.

10,994.—The matters they contain are partly in a chemical state, and partly in a mechanical state? Partly chemical and partly mechanical.

10,995.—In each case, both mineral and organic in their nature? Yes.

10,996.—With respect to the mechanical matter, of what does that consist? That is partly organic and partly mineral.

10,997.—Those matters being contained in water, what modes have been adopted of getting rid of those contents? The usual means of getting rid of the mechanical contents of water, are the mechanical means of subsidence and filtration.

10,998.—Is either of those to be relied on to get rid of all those matters which are in mechanical suspension? Neither of them can be relied on under all circumstances.

10,999.—As to subsidence, for example, why is that defective? In the case of subsidence, the mechanical matter is sometimes in a state of subdivision, which is so very minute that no filter will arrest it; that happens quite usually in the case of Thames water whenever there is a flood in the water; whenever there is a flood, there is mineral matter in a state of exceedingly minute division that will neither settle, nor will it entirely filter; after being filtered by good filters, you still see what we call a milkiness in the water.

11,000.—As to the organic matter, will either filtration or subsidence remove the whole of that? Organic matter will not all be removed by filtration.

11,001.—Are there any parts which will pass through the filter? The ova of the animalculæ will pass through; very minute insects will pass through, and some of the smaller and very active animalcules will pass through.

11,002.—Will those be reproduced on the other side of the filter? They are found to be reproduced on the other side in the usual practice. Then with regard to filtration in reference to organic matter, the grosser parts of the organic matter are stopped upon the surface; all the larger creatures such as shrimps are stopped undoubtedly by the filter. The effect of this stopping is pernicious; they are stopped there and die and decay, and the next water coming on gets an infusion of the dead matter.

11,003.—It becomes contaminated? It does.

11,004.—*By the Committee.* You say they die; is that on the surface of the sand? On the surface of the sand; these being animals whose

native habitation is the water, on being deprived of water, when the surface of filtration is left bare, they die for want of water.

11,005.—If the surface of the sand at the top of the filter is left dry? Which is usual in the operation of filtering.*

11,006.—If there is water kept constantly over the sand, then they would not die; is that so? The death I refer to is owing to the want of water.

*Must refer to ordinary house filters.

# Superintendent's Report.

WATER COMMISSIONERS' OFFICE,
Chicago, Ill., January 1st, 1861.

*Board of Water Commissioners*
*of the City of Chicago:*

GENTLEMEN: It will be unnecessary for me at this time to enter largely into the discussion of matters pertaining to the enlargement of the Works, the best method of obtaining a more pure quality or a more abundant supply of water, as all these subjects have been treated at length in the Report of E. S. Chesbrough, Esq., as Consulting Engineer, under the direction of your honorable Board. It will be expected, however, that I shall make a brief statement of the present condition of the Works under your charge, the amount of extension the past year, and perhaps make some few suggestions for the future.

I think we may consider ourselves peculiarly fortunate that there has been no serious derangement, either in the machinery or any of the parts connected with the Works, whereby the city has been deprived of water for any length of time. In fact, the disastrous consequences which might follow any such derangement have been so impressed upon the minds of all the employees, that every possible precaution has been taken to avert such a calamity.

But we may not always expect to be thus highly favored. Machinery, however perfect in all its parts, and however closely watched, from constant use becomes impaired. Sometimes, imperceptibly, the particles of which metals are composed become detached, one by one, and thus disintegration continues until the parts subjected to the greatest strain give way entirely. We are not therefore to infer from the fact that no serious breaks have occurred under the management of skillful engineers, that we have a sure guarantee for the future.

One reason for the comparatively small amount required for repairs, no doubt, is the low and uniform rate of speed which has been necessary to keep up the supply. This rate, you will notice by the table annexed, has to be, and will continue to require to be, accelerated, as the rate of consumption increases, thereby greatly magnifying the chances for breakages.

The following table shows the gradual increase of consumption for the years 1858, 1859, 1860:

AVERAGE DAILY CONSUMPTION.

| | |
|---|---|
| 1858, - - - - - - - - | 2,991,412 gallons. |
| 1859, - - - - - - - | 3,877,910 " |
| 1860, - - - - - - - - | 4,703,524¾ " |

By an examination of the tables furnished by the Engineer in charge, and his accompanying remarks, appended to this Report, to which I respectfully call the attention of the Board, it will be perceived that the largest amount pumped in any one day was 6,220,368 gallons. At this rate of increase, the maximum which the small engine is able to supply will be reached about the year A. D. 1862, without estimating the very probable increasing demand for mechanical purposes consequent upon a revival of business.

It is true that both engines might be run at the same time, after the new main which is in contemplation is completed; but this would only be deferring for a short time what would unavoidably have to be done very soon, viz: the erection of additional pumping works to ensure always a full supply.

It is certainly very desirable, where the reservoir capacity is as limited as ours is, that the pumping power should be equal to double the amount required for constant use. Judging from past experience, I should think it might require eighteen months at least, and perhaps two years, to erect the additional buildings and complete the machinery ready for use, including, of course, the time required for making preparations, getting up plans, etc. Should you decide to proceed in this matter, plans and estimates should be presented for that purpose as soon as convenient.

ENGINE HOUSE.

The Engine House is now in good repair. It was deemed advisable to erect two chimneys, one on the east side of each of the boiler rooms, for their better accomodation. They are 11 feet square at

the base, which is 30 feet high; the shaft is 11 feet diameter at the base, and 7½ feet at the top, and 58 feet high, made round and surmounted with a stone cornice and coping, making the entire height of the chimneys 88 feet. The inside or flue is made circular, with an air space between it and the outer wall. The entire cost of these chimneys, exclusive of the flues to connect the boilers, is $2,247.91. The flue connecting the south boilers is completed, which cost, including alteration in roof, &c., $339.70. Amount expended in replacing brick walls in engine house and tower, and removing old ue, $88. Other repairs at engine house, $121.62. Making the whole amount expended at the engine house the past year, $2,797.23.

### AQUEDUCT.

The Aqueduct remains in good condition. $34.63 has been expended in making additional gates, man-holes, &c.; also, $47.08 for two additional strainers to prevent fish from passing into the pump well, making three through which the water has to pass before reaching the well. Even with these screens in use, we are not able to keep them out entirely, but we have been less troubled with them since the screens were put in than before.

### BASIN IN THE LAKE.

The basin in the lake remains in good order, although its capacity is rendered somewhat less by deposits of sand.

### PIPE EXTENSION.

Our pipe extension has been considerably less this season than last, being only about six miles, as follows:

| | | |
|---|---|---|
| 338 feet | - - - - - - | of 8 inch. |
| 8,825 " | - - - - - - | of 6 " |
| 22,636 " | - - - - - - | of 4 " |

Total, 31,799 feet or 6 $\frac{1119}{5280}$ miles.

The location and size of pipes, &c., will be found in the appropriate table.

### HYDRANTS.

Only 27 new hydrants have been added to the Works the past year, all of the Hamilton patent. The whole number now in use is 446. There have been purchased 25 of the Hamilton Improved Hydrants, 8 of which are now in use. D. C. Cregier, Esq., Engineer at the pumping works, is about perfecting a plan for a hydrant, which

contains some features worthy of attention. It is a hydrant and stop cock combined, and is so constructed that the hydrant proper can be taken out and repaired at pleasure, without shutting off the district or street to which it is attached.

For the benefit of the Fire Department, as well as for future reference, I have prepared a table showing the location and size of every hydrant in the city, also, the size of the pipes to which they are connected.

We received, late in the season, six hydrants, manufactured by Race, Mathews, & Co., Lockport, N. Y., none of which have been used, consequently their merits have not been tested by us.

STOP-COCKS.

The number of stop-cocks inserted the past year, are 11 four inch and 4 six inch. The location of each will be found in the appropriate table.

RESERVOIRS.

The reservoirs are all in good repair. The one in the South Division has not been as useful as it would have been had the mains been large enough to supply the South Division and fill the reservoir at the same time with the others. This difficulty will be removed when the new main is completed, as proposed.

The amount expended for repair on the three reservoirs the past season, is $56.67.

Were the grounds properly fenced and beautified, I think there would be less danger of the buildings being injured and defaced, besides being an ornament to the neighborhoods in which they are located. There is now no appearance of weakness in either of the reservoirs. Some of the small rods near the top of the tanks have been broken by the accumulation of ice upon them, and I would suggest that it might be well to provide some means for warming them through the coldest portions of the season. A small outlay for steam boilers, with pipes to carry steam to the bottom and sides of the tank, would prevent the ice from accumulating, and would require to be in use but a small portion of the time.

It gives me great pleasure to be enabled to represent the Works in good condition, and to certify to the good conduct and zeal displayed by all the employees, to discharge their respective duties with fidelity, and to promote the interests of the departments to which they are respectively connected.

All of which is respectfully submitted.

B. F. WALKER, *Superintendent.*

# Engineer's Report.

ENGINE HOUSE, C. W. W.,
January 1st, 1861.

*Superintendent Chicago Water Works:*

SIR: Herewith may be found the usual annual statement of the operations of the Pumping Works, and such other matters connected therewith as may be deemed of interest.

The operations of this branch of the Works have been of such an uniform character for several years past, that the present statement differs but little from those of former years, except in the amount of water pumped, which, of course, steadily increases, as will be seen from the following table, exhibiting in gallons the

AMOUNT OF WATER PUMPED EACH MONTH FOR THE YEARS 1858, 1859 AND 1860.

| Mon. | 1858. | 1859. | 1860. | Mon. | 1858. | 1859. | 1860. |
|---|---|---|---|---|---|---|---|
| Jan. | 81,538,179 | 106,905,665 | 132,284,454 | July | 101,670,736 | 133,800,336 | 166,394,640 |
| Feb. | 69,426,515 | 106,401,412 | 130,800,720 | Aug | 107,176,652 | 123,266,556 | 152,427,690 |
| Mar. | 82,677,463 | 102,415,983 | 150,331,680 | Sept | 108,534,540 | 131,735,847 | 132,272,202 |
| Apr. | 82,600,782 | 89,994,235 | 132,930,546 | Oct. | 101,046,605 | 141,527,040 | 148,710,195 |
| May | 82,279,920 | 116,107,263 | 141,171,078 | Nov | 86,385,840 | 127,342,018 | 150,493,248 |
| J'ne | 90,211,505 | 113,098,416 | 148,197,024 | Dec. | 98,316,722 | 122,653,139 | 130,773,075 |
| Total for each year,..... | | | | | 1,091,865,459 | 1,415,147,910 | 1,716,786,552 |

Showing an increase in 1859 over 1858 of over 29½ per cent., and in 1860 over 1859 of over 21¼ per cent.

Our record shows the demand for water in certain seasons of the year to be quite uniform; for instance, the engines are used daily, and for several weeks in succession will not differ thirty minutes per day in running time, the speed of the engines not varying two-tenths of a revolution per minute, consequently the amount of water pumped is equally as uniform.

It is frequently the case that in extreme cold weather, as much water is pumped as in hot weather. From midnight to daylight the draught on the water is most perceptible, it being then nearly as much as in the business hours of the day.

One or the other of the engines have been used daily for the past seven years.

The present engines were erected, one in 1853, the other in 1857. In that time they have made between twelve and thirteen million revolutions, and on no occasion has either of them been rendered unservicable by reason of any important breakage. This is, perhaps, fortunate, considering the large portion of the time they have been in motion, and I think may be attributed mainly to the uniform and limited rate of speed at which they have been used. However, as the demand for water increases, so must the speed be accelerated, thereby multiplying the chances for them to fail. For the past year the engines and boilers have performed in the usual satisfactory manner. The repairs have been done by the employees so far as tools would permit. The work done has been more important than heretofore, and exceeds in amount that done on any previous year since their erection.

The important repairs consist in a new steam piston for the old engine, new valve stems for main pumps of large engine, and the completing of the repairs of the north boiler. This boiler was used for the first time on the 5th of April last. The alterations and repairs bestowed upon it have made it all that could be desired. On the 18th of September it received a new felt covering, from which is found good results.

The new steam piston for the old engine was used for the first time on the 11th of October, and found to add much to the general action of the engine, which is now in good order.

The large engine is also at the present time in good order.

The two south boilers are in good repair, aud work well. The new chimney for these boilers was completed on the 15th of September, and connected by an iron pipe on the 1st of December, the old pipe leading to the "tower" having been removed. The new chimney is found to answer its purpose well, but may need lightning conductors for protection. Some experiments have been made the past year on the prevention of smoke, but they were only partially successful. Two plans have been tried, one of which is simple and cheap, and has given evidence of its practicability to save fuel and create a more

perfect combustion. We hope the coming year to be more successful in abating the smoke from bituminous coal, which it seems must become in many cases a nuisance. The well has been cleaned several times the past year, and since the new gates were put in the inlet pipe, this work can be done with more facility.

Most of the coal received the past year has been of good quality, the largest amount being Chippewa, from Price & Morris.

The city has at no time during the past year been without water from any failure on the part of the pumping machinery.

### THE LARGE ENGINE

has been used during the year, 3,258 hours and twenty-seven minutes, making in that time 1,375,570 revolutions, delivering 1,122,465,120 gallons of water, and consuming 3,353,526 lbs. of coal, 202,095 lbs. of which amount was used for keeping steam when not running. The largest amount pumped in one day was on Thursday, July 19th, being 6,220,368 gallons, running $17\frac{4}{6}\frac{7}{0}$ hours. The smallest amount pumped in one day being on Friday, September 28th, 3,690,768 gallons, running $11\frac{2}{6}\frac{3}{0}$ hours.

### THE SMALL ENGINE

has been used the past year 2,388 hours and forty-one minutes, making 1,145,128 revolutions, delivering 594,321,432 gallons of water, and consuming 1,889,083 pounds of coal, of which amount 60,350 pounds was used for keeping steam when not running. The largest amount pumped in one day was on Sunday, July 1st, 5,065,440 gallons, running $21\frac{1}{6}\frac{0}{0}$ hours. The smallest amount pumped was on Sunday, April 15th, being 3,321,600 gallons, running $14\frac{3}{6}\frac{0}{0}$ hours.

The following table gives the operations of both engines more in detail:

| Months. | No. of days run | No. of h'rs run pr mo. | | Gallons of water pumped per m'h. | Av'age h'rs run p'r day | | Av'age water pumped per day. |
|---|---|---|---|---|---|---|---|
| | | hours | min | | hours | min | |
| January, | 31 | 447 | 27 | 132,284,454 | 14 | 25 | 4,267,241 |
| February, | 29 | 378 | 47 | 130,800,720 | 13 | 04 | 4,510,369 |
| March, | 31 | 438 | 39 | 150,331,680 | 14 | 09 | 4,849,409 |
| April, | 30 | 500 | 42 | 132,930,546 | 16 | 42 | 4,431,019 |
| May, | 31 | 476 | 07 | 141,171,078 | 15 | 22 | 4,553,905 |
| June, | 30 | 423 | 59 | 148,197,024 | 14 | 08 | 4,939,901 |
| July, | 31 | 476 | 37 | 166,394,640 | 15 | 23 | 5,367,569 |
| August, | 31 | 564 | 01 | 152,427,690 | 18 | 12 | 4,917,023 |
| September, | 30 | 534 | 57 | 132,272,202 | 17 | 50 | 4,409,073 |
| October, | 31 | 447 | 00 | 148,710,195 | 14 | 25 | 4,797,103 |
| November, | 30 | 438 | 23 | 150,493,248 | 14 | 37 | 5,016,442 |
| December, | 31 | 520 | 29 | 130,773,075 | 16 | 47 | 4,218,486 |
| Total, | 366 | 5647 | 08 | 1,716,786,552 | | | |

It will be seen from the foregoing that I am enabled to report the engines, boilers, &c., in good working order at the present time, and I do not know of anything of importance which needs renewing or repairing, except the old engine, whose general appearance would be much improved by a coat of paint.

The men employed at the Engine House have filled their respective positions for several years past, and have, therefore, become proficient, performing their duties in a satisfactory manner.

Mr. Trautman, Assistant Engineer, has completed his fourth year, as such, in which time, he has been found a competent and industrious man.

Respectfully,

DEWITT C. CREGIER,

*Engineer.*

RECAPITULATION.

| Engines. | Hours. | Min | Revolutio's | Gallons of water pumped. | Coal used for pumping. | Coal used for keeping steam. | Total coal consumed. |
|---|---|---|---|---|---|---|---|
| Large, ..... | 3,258 | 27 | 1,375,570 | 1,122,465,120 | 3,151,431 | 202,095 | 3,353,526 |
| Small, ..... | 2,388 | 41 | 1,145,128 | 594,321,432 | 1,828,733 | 60,350 | 1,889,083 |
| Total, ..... | 5,647 | 08 | 2,520,698 | 1,716,786,552 | 4,980,164 | 262,445 | 5,242,609 |

## PIPE EXTENSION.

Distribution pipes have been laid the past season as follows:

### SOUTH DIVISION.

| Size of Pipe. | Street. | Between what Street. | No. of feet. |
|---|---|---|---|
| 4 inch. | Old Street, | Indiana Av. to Prairie Av. | 442 |
| 4 " | St. East Michigan Av. | From South Water North. | 200 |
| 4 " | Prairie Avenue, | South of Old Street. | 410 |
| 4 " | Dearborn, | Archer Road to South St. | 1,077 |
| 4 " | Monterey, | Michigan Av. and Ind. Av. | 413 |
| 6 " | Indiana Avenue, | Monterey and Buenavista. | 706 |
| 8 " | Clark Street, | Archer R'd and Commerce. | 338 |
| 6 " | " " | Commerce and South St. | 468 |
| 6 " | Couch Alley, | Clark and Dearborn. | 412 |
| 4 " | | For Hydrants. | 64 |
| | | Total, | 4,530 |

## NORTH DIVISION.

| Size of Pipe. | Street. | Between what Streets. | No. of feet. |
|---|---|---|---|
| 4 inch. | Superior, | Pine and St. Clair. | 350 |
| 4 " | Grand Haven Slip, | From Wolcott east. | 384 |
| 4 " | Division, | " " " | 450 |
| 4 " | Schiller, | Wells and Sedgwick. | 1,060 |
| 4 " | | At Belcher's Sugar house. | 194 |
| 4 " | Huron, | Sedgwick and Townsend. | 380 |
| 4 " | Erie, | Sedgwick and Market. | 406 |
| 6 " | Orchard, | Willow and Center. | 1,640 |
| 4 " | | For Hydrants. | 120 |
| | | Total, | 4,984 |

## WEST DIVISION.

| Size of Pipe. | Street. | Between what streets. | No. of feet. |
|---|---|---|---|
| 4 inch. | Reuben, | Madison and Warren. | 332 |
| 4 " | Warren, | Reuben and Pub. School H. | 1,000 |
| 4 " | Washington, | May and Elizabeth. | 920 |
| 4 " | Elizabeth, | Washington and Madison. | 500 |
| 4 " | Mitchell, | From Stewart Av. east. | 1,205 |
| 4 " | Sangamon, | W. Indiana and Third. | 746 |
| 4 " | Warren, | Wood and Leavitt, | 2,690 |
| 4 " | Park Avenue, | " and Cornelia. | 302 |
| 6 " | W. Indiana street, | Carpenter and Curtis. | 334 |
| 4 " | Curtis, | W. Indiana and Fourth. | 441 |
| 4 " | " | Randolph and Madison. | 953 |
| 4 " | " | W. Indiana and Hubbard. | 395 |
| 6 " | Hubbard, | Carpenter and Elizabeth. | 1,593 |
| 6 " | " | Robey and Reuben. | 2,682 |
| 4 " | Pierce, | Desplaines and Halsted. | 876 |
| 4 " | Jackson, | Throop and Loomis. | 667 |
| 4 " | Loomis, | Jackson & Van B. and S. of Van Buren. | 627 |
| 4 " | Paulina, | Lake and Walnut. | 300 |
| 4 " | Walnut, | Paulina and Wood. | 658 |
| 4 " | Wood, | Walnut and Hubbard. | 1,380 |
| 4 " | Green, | Munroe and Adams. | 495 |
| 4 " | Elizabeth, | Kinzie and West Indiana. | 806 |
| 6 " | Randolph, | Elizabeth and Sheldon. | 990 |
| 4 " | Sheldon, | Randolph and Washington. | 464 |
| 4 " | Washington, | Sheldon and Alley, near Hay's House. | 573 |
| 4 " | | For Hydrants. | 356 |
| | | Total, | 22,285 |

LIST OF STOP-COCKS INSERTED IN 1860.

## WEST DIVISION.

| Size Stop-Cock. | | | Location. | | | | | Kind used. |
|---|---|---|---|---|---|---|---|---|
| 1 | 6 | inch, | West | Line of | Randolph, | cor. of | Elizabeth. | Walker's. |
| 1 | 6 | " | " | " | Hubbard, | " | " | " |
| 1 | 6 | " | " | " | " | " | Cornelia. | " |
| 1 | 4 | " | North | " | Kinzie, | " | Wood. | " |
| 1 | 4 | " | " | " | " | " | Elizabeth. | " |
| 1 | 4 | " | At the Alley South of Galena Round house. | | | | | " |
| 1 | 4 | " | On Mitchell street, for Ft. Wayne Railroad. | | | | | " |
| 1 | 4 | " | West line of Warren at Cornelia. | | | | | " |
| 1 | 4 | " | " | | Washington at Elizabeth. | | | " |
| 1 | 4 | " | " | | Park Avenue at Cornelia. | | | " |
| 1 | 4 | " | " | | Throop at Jackson. | | | " |
| 1 | 4 | " | Blow off at Randolph street bridge. | | | | | " |

## SOUTH DIVISION.

| | | | | |
|---|---|---|---|---|
| 1 | 6 | " | South line of Indiana at Monterey. | " |
| 1 | 4 | " | Blow off in Couch Alley, bet. Clark and Dearborn. | " |

## NORTH DIVISION.

| | | | | |
|---|---|---|---|---|
| 1 | 4 | " | On Michigan street at Belcher's Sugar Refinery. | " |

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